Contractors and Engineers Monthly

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PICKS and SHOVELS

By O. E. POTTER

"Ghost Road" Disappears

The mention of a "ghost road" brings to mind phantom cars and weird transparent figures at their wheels or, having just seen that mad, fantastic movie "Topper," I am inclined to wonder if the ghost road isn't just part of a Hollywood set, which has disappeared by means of a zipper arrangement now that there is no longer a need for it.

Further investigation of this "ghost road," accompanied by much whistling to fortify one's courage and all that sort of thing, indicates that the arrival of cooler weather has caused its disappearance. The prosaic explanation of this phantom highway offered by G. J. Irwin, Highway Engineer for the B. F. Goodrich Co., is that the expansion of concrete under the blistering rays of the summer sun reaches a maximum aggregate length of 61 miles for the 111,350 miles of concrete highway in the United States.

In his investigation of the expansion of concrete pavements, Mr. Irwin found that a regular 60-foot slab of concrete changes as much as 0.4 inch with a variation of 100 degrees in temperature. If the pavement is placed at 80 degrees, and the temperature subsequently drops to zero, we may expect a shrinkage of as much as 0.3 inch for a slab 60 feet long. This seems quite understandable to me—I'm sure I shrink much more than 0.3 inch when the temperature drops to zero!

Expansion of concrete caused by extremely hot weather reaches a maximum of nearly 1 yard to the mile, as compared to the length in zero weather.

All of which is very interesting and a real contribution to the science of road building, but I still prefer to think of the "ghost road" as the one down which Topper rode in that honey of a car driven by a lovely ghost.

IN THIS ISSUE

Feather River Route Open

First surveyed for a wagon road in 1867, the Feather River Highway on California Route 24, in Butte and Plumas Counties, on which work has been under way since May, 1928, was dedicated to public service on August 14 by Governor Frank Merriam. This $8,000,000 highway, the dream of engineers for 70 years, was built through solid rock and over mountain streams, at a cost of $100,000 a mile. The accompanying article describes some of the tunnel construction problems on this project.

Shelby County, Tenn., To Build Cotton Road

The Use of Tars for Roads Gives Best Surfaces at Lowest Costs, According to Commissioner L. F. Jones.

"MEMPHIS is the largest inland cotton market in the world and if anybody has cotton roads, Shelby County should," remarked E. W. Hale, Chairman of the Shelby County, Tenn., Commission, in a newspaper interview recently. One mile of road is to be

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Tunnel Construction In Feather River Canyon

(Photos on page 48)

SUNNY California richly deserves its name but its well-organized Division of Highways is constantly plotting to dodge the high mountain passes where heavy snowfalls completely block traffic for varying periods from early autumn till early summer. A project to provide a low-level outlet avoiding snow has been pushed to completion on State Route 21 extending northeasterly from Oroville toward Quincy and Lake Almanor through the scenic Feather River Canyon, in Butte and Plumas Counties. The Feather River route is approximately 78 miles in length, of which about 65 miles have been built by convict labor camps which were first established in June, 1928, and about 15 miles by contract.

Poor rock in some sections, a large rock slide that blocked the stream and raised the flow line 30 feet and the rapid construction of three large bore tunnels featured the work.

Convict Labor

The manner in which convict labor has been used in many states has given the term an odious meaning. California has dealt with the convict in such a manner that it is an honor for him to be permitted to work in the convict camps where there are no armed guards and every man is on his honor. He earns his wages and pays his way, producing highways that otherwise might not be built for many years to come. He builds character and brawn that serve him well when he is again a free man seeking work in the world. This remarkable system of penal labor was described in an article devoted entirely to its organization and administration on page 2 of the November, 1936, issue of CONTRACTORS AND ENGINEERS MONTHLY.

The Tunnels

The character of the country, with sheer slopes from the top of 500-foot cliffs down to the river, made the use of tunnels advisable in three places along the work. The survey parties and the first drilling rigs had to be slung from above with cables to permit work. Equipment was carried in as the work progressed and the tunnels had to be worked one at a time with pioneer cuts just large enough to permit a shovel to get through and work on the open cut ahead approaching the next tunnel.

The tunnels are uniformly 22 feet 2 inches high and 30 feet 4 inches wide at the roadway line. Tunnel No. 1 is 261

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C. & E. M. Photo

The Battery of Compressors Close to the Tunnel on the Feather River Canyon Project

California Builds Low-Level Highway to Avoid Snow on Trans-Continental Route

Elevating Grader Proved Effective On 21.8-Mile Grading Job in Oregon

(Photo on page 48)

UNTIL last fall, it had been many years since an elevating grader had been used in Oregon on highway construction work. Then a piece of construction was undertaken where conditions were just right for such operation. This is known as the Burns-Buchanan section of the Central Oregon Highway.

This section is 21.8 miles long, nearly level and passes through sage brush desert land. A contract for clearing and grading, amounting to $125,000, was awarded to M. L. O'Neil & Sons, Burns, Ore. Another contract was let to Warren Northwest, Inc., for surfacing and oiling.

The grading contract was let October 1, 1936, work was started October 20, and was completed this past summer. The clearing areas were mainly sage brush, hand labor being employed for clearing and grubbing.

Common excavation was nearly all material in side borrow stretches. It was carried out almost wholly by means of a Caterpillar elevating grader, using a 48-inch belt. This equipment has been able to average 350 to 450 cubic yards per hour. The grader made a cut 1 foot in depth and 1 foot in width, and was pulled by a 61-hp Caterpillar tractor at from 2 to 2½ miles an hour.

The elevating conveyor of the grader was set so that the discharged material fell very nearly in place, and required very little side movement. For endwise movement, or drifting of material, and fine grading of cut ditches and grades, three tractors were used, with 12-yard LeTourneau scrapers or with pull blades. With this equipment, the contractor was able to grade as fast as the clearing crews could work. The fine grading kept about 1¾ miles in the rear of the rough grading.

Last winter there were several weeks of very cold weather, freezing the ground to a depth of more than a foot. But the grader was able to get under the crust and dug through this fairly well.

At the west end of the section, there was a cut containing 12,000 cubic yards of solid material. This was loosened with a LeTourneau rooter and excavated with scrapers.

At the Buchanan end, there was about 30,000 cubic yards classified as solid rock. Most of this was blasted and then moved with bulldozers, or with scrapers for the longer hauls, and without the use of a shovel.

Resurfacing Old Concrete With Two-Course Hot Mix

Olof Nelson, Contractor, Sets Up Plant for Hot Mix in Own Yard in Logan, Utah

WORKING two 5-hour shifts daily on the road, Olof Nelson of Logan, Utah, was able to lay 1,400 feet of 2-course asphaltic concrete surfacing over an old concrete pavement 22 feet wide. His plant was located in his own equipment yard in Logan at one end of the work. This is another of the numerous contracts on U. S. 91 operating on this major north and south highway during the summer of 1936.

The Hot-Mix Plant

Nelson owns a sand and gravel pit about ½ mile from the plant where the aggregate for the asphaltic concrete was produced. The material, without screening other than the removal of all stone over 1¼-inch screen size, was stockpiled close to the plant where the fines were added by mixing with three teams and fresnos which pulled the material to the hopper over the feed belt where the rate of flow was controlled entirely by a horizontal hand-operated gate. The specifications required that from 8 to 11 per cent of the material must pass a 200-mesh sieve and that 4 per cent must be rock dust. As the rock dust was missing from the pit operated by the contractor he shipped in the dust, unloading it on the siding in his own yard and piling it with the other aggregates.

The belt conveyor carried the material to the upper end of a 50-inch diameter by 20-foot long oil-fired drier having two burners. The dried aggregate was then carried to the hot bins and screened into four sizes: all minus ⅛-inch, ¼-inch size, ½-inch size and from ½ to 1¼-inch material. In addition there was a rock dust bin at the plant. The screens were double-deck vibrating units. The hot-mix plant is a Standard portable asphalt plant made by the Standard Steel Works of Los Angeles, Calif.

The asphalt was brought in by tank cars and pumped to a 6,000-gallon insulated asphalt tank. There is also a 6,000-gallon fuel oil tank for storage. A Crocker-Wheeler 100-hp motor drives the plant and separate 50-hp motor operates the drier. The asphalt was pumped at night from the cars of the Utah Oil Co. with the same pump that was used for circulating the material during the day shifts.

The batches were weighed out in a single batching unit equipped with a Hardy Gravity Indicator by which the batch man can release the various stops for the increasing weights of the aggregates and use one beam scale balanced five times for the five aggregates. A separate dial scale is used for the asphalt. The batches were mixed in the pug mill for 45 seconds after the asphalt was added. The batches for the two courses were made up as follows:

	Leveling Course	Surface Course
Minus ⅛-inch screen	600 pounds	650 pounds
⅛-inch	500 pounds	200 pounds
¼-inch	900 pounds	200 pounds
½ to 1¼-inch	None	840 pounds
Rock dust	None	100 pounds
Asphalt	70 pounds	90 pounds

Preparing the Roadway

The first operation in the preparation of the road for the resurfacing was to blade back the remaining shoulder gravel to save it for the final shoulder on the improved road. Then the shoulder was scarified so that the patrol grader could cut the trench against the concrete slab for the forms for the asphaltic concrete surfacing. These forms consisted of 4 x 8-inch planks staked against the concrete with 2 x 2-inch stakes. The planks were blocked up to grade with small wooden blocks and then backfilled with earth under and against the planks.

The surface of the old pavement was then sprayed with a rapid-cure cut-back asphalt, using naphtha as the cut-back agent. The asphalt was hauled in a 600-gallon tank mounted on a Chevrolet chassis, with an Onan power unit running a 1-inch pump delivering the material to the hand spray. This was hand-broomed to insure complete coverage and was then ready for the leveling course.

Spreading the Courses

The leveling course was spread by a drag 10 feet wide and 18 feet long with four cross pieces, all of 3 x 8-inch planks, and with ½-inch tie rods at each cross piece. The drag was manned by ten men and a foreman. The leveling course was a minimum of ½-inch thick and a maximum of whatever was required to bring the surface of the old concrete up to grade. The maximum reached as much as 3 inches in places. A fleet of eight trucks was required to haul the leveling-course material out to the road from the contractor's plant. The leveling course was rolled with a 10-ton 3-wheel Buffalo-Springfield gas-powered roller.

The surface course was dumped from the tail-gates of the trucks directly onto the leveling course in a windrow about 15 inches high along the center line of the pavement. Then ten men shoveled the material loose to the front of the Ord 22-foot screed and kept it about 8 inches high on the screed. This weight of the material on the screed gave some compaction to the surface course. Every pound of the windrowed material was shoveled from its original location so as

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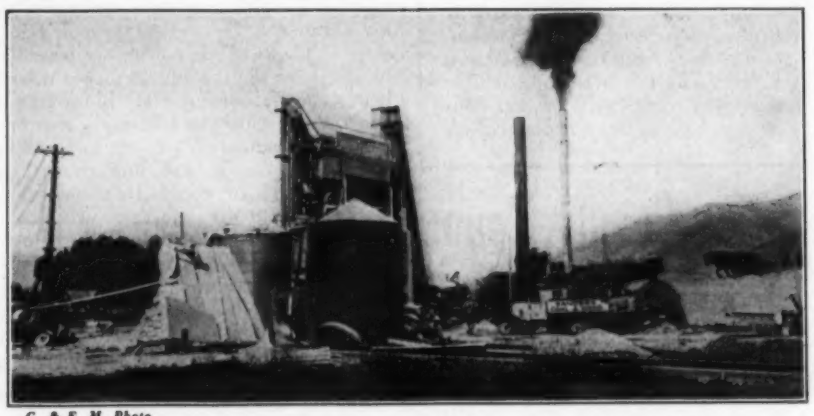

C. & E. M. Photo
Olof Nelson's Standard Portable Asphalt Plant in Logan, Utah

Grading Tough Clay For New 3-Strip Road

Dale Engineering Co. Completed 6.32-Miles of Widening Old Road, and New Concrete Paving

TO start with, it was no picnic to survey the route for N. Y. State Highway 12 north from Utica, about 50 per cent of which was new location. To eliminate many winding curves, the engineers struck boldly across country only to be mired in a top muck, 2 feet beneath which lay an impervious clay that sealed in every drip of melted snow and spring rains, making hip boots the style for the survey party. Then the yellow clay on top, backed up by a tough blue clay, provided a problem of excavation. The blue clay was tough as hard rubber when dry but moisture made it of gravy-like consistency. Placed dry in the fill it stood up well, but a few rains and it headed for the nearest ravine.

Excavation and Fills

On this 6.32-mile contract of the Dale Engineering Co. of Utica, N. Y., the first 2½ miles consisted of widening an old 16-foot concrete pavement to 30 feet and then surfacing the entire width with bituminous macadam. The balance was straight 3-strip concrete pavement, mostly on new location. The largest cut was about 16 feet deep and accounted for about 8 per cent of the 157,000 cubic yards of excavation on the job. In this deep cut excavation went through the top muck, yellow clay, top blue clay and finally struck hard pan. It was handled in two lifts by a Northwest 1¼-yard power shovel which helped out the second Northwest shovel, a 1-yard machine, on the balance of the excavation.

The highest fill on the job was 45 feet high laid down in 6-inch layers even though the concrete was not going on in the same year. New York State specifications permit 12-inch layers if the fill is to lay over one winter. All fills were rolled with a Buffalo-Springfield 10-ton steam roller. The work of excavation and hauling was subcontracted to Smith & Husted of Elmira, N. Y.

There were one or two slides caused by the blue clay melting into a gravy or pea soup consistency during wet weather. The slopes on the fills as the

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C. & E. M. Photo
A Ford Batch Truck Delivering a Batch to the MultiFoote Paver on the Dale Engineering Co. Contract

The Snow King Rotary Snow Plow Owned By Douglas County, Nebr.

How Douglas County Keeps Roads Open

Due to Good Equipment and Well-Laid Plans, Snows In Nebraska Are Defeated

By WILLIAM GREEN, County Surveyor and Highway Commissioner, Douglas County, Nebraska

DOUGLAS County, Nebraska, lies in the Missouri, Elkhorn and Platte River valleys, rises west from the Missouri River and breaks sharply into the Platte River valley. The terrain is rolling with the general trend of the ridges towards the north and south, paralleling the major watercourses.

The general road system is rectilinear following the section and one-half section lines, necessitating heavy cuts and fills on the river approaches and lighter on the small tributary creeks. All the cuts have been troublesome in winter due to the depths and the shading, but in the past two years have been doubly so due to the absence of vegetation.

In times past most of the land contiguous to the highways was planted with corn, and uncropped land was covered with a heavy growth of native timber, which provided a barrier to the snow and kept heavy drifts from the highways but, due to the drought and the depression, the corn has been cut early for feed and the timber for fuel, thus necessitating the use of snow fence in large quantities. Our worst snow storms accompanied with high winds usually come from the northwest and northeast, but occasionally a storm will come in from the southeast or southwest and fill the cuts. Snow fence has been provided for most of the cuts and functions admirably well up to its capacity, but recurrent snows with wind have a tendency to slide over the drift made by the snow fence and fill the cuts.

Organization

Late in the fall after intensive highway maintenance has been discontinued, the various power units are overhauled and removed to strategic points in the county and stored, and skeleton crews organized for immediate call from the County Highway Commissioner. These

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Weed Cutting Along Our Roadsides

That bane to hay fever sufferers, rag weed, in many cases 5 feet high and with a stalk that resists ordinary mowing methods, was seen on many county roads this summer. Mowing road shoulders to remove this and other growth is necessary, not only for the protection of people susceptible to hay fever but also for very practical reasons from the highway supervisors' standpoint.

High weeds are a potential hazard anywhere along the road because they hide small and medium-sized animals and even humans, particularly children, who may dodge out into the path of an approaching vehicle, resulting in a serious accident. On curves and at intersections, weeds are a very serious source of danger.

If the weeds are still standing when snow begins to fall, they make a perfect snow fence, but in the wrong place. Being close to the edge of the road, they pile snow right in the road from which it must be removed at considerable expense. Further, the weeds act as a reinforcing for the snow, making it more difficult to push back accumulated snow on the shoulders, thus narrowing the highway as the snow piles up during the winter.

We noted an editorial in a Richmond, Ind., paper just after we had interviewed Ernest Coffin, County Highway Supervisor of Wayne County, Ind. The editorial constituted an appeal for the removal of tall weeds and brush at the most dangerous intersections of county roads but pointed out that the view at these many intersections will remain obstructed because the County Highway Department does not have enough money to clear all the dangerous places. Hope is expressed that the County Highway Supervisor will be given enough money in 1938 to remove the weeds at all road intersections, to which we add "along the shoulders of *all* roads."

The newspaper editorial continues, "Confronted with this condition, common sense should dictate to motorists using the county roads that they proceed carefully as they approach an intersection. The hazards of obstructed intersections caused by weeds and tall corn call for careful driving. It is the only way in which traffic accidents can be avoided."

Very true, but the rising number of traffic accidents has proved that motorists are incompetent to take the responsibility for safety on the highway, so all possible hazards must be removed as promptly and efficiently as funds allow, if the toll of lives on the highway is to be decreased.

Highway Tools Complete A Cycle

About the first tool, other than a hand shovel, used to build or improve a road was the split-log drag, adapted by the farmers from their own work in smoothing over a sowed field. This development of agricultural implements brought into being the disc harrow and the spring tooth harrow which have performed inestimable services for the farmer in cultivating fields and breaking up clods.

The farm implement has again reached out to aid the builder of roads, for it has been found that about the best results in the mixing of aggregate and bituminous materials on the road for either base or surfacing are accomplished with the disc harrow and the spring tooth harrow. To be sure, the good old reliable blade is used for the final work and for spreading but it does its best work after the materials have been initially mixed with the agricultural implements.

Let us add another feather to the cap of the agriculturists by giving them credit for the fact that most of these harrows are pulled by agricultural rather than industrial tractors as the pneumatic tires on the light-weight agricultural tractors give the minimum compression on the material during mixing.

Oldest Iron Bridge Preserved in England

What is reported to be the world's oldest cast iron bridge still stands today spanning the River Severn in Shropshire, England, where it was constructed between 1777 and 1779 to replace a ferry. The bridge was built by the Coalbrookdale Co., Ltd., of which the Horsehay Co. Ltd., formed a part until 1886. Until about 2 years ago, this bridge carried vehicular traffic, but it has since been closed to vehicles. Foot passengers are still allowed to use it, however. It now is operated as a toll bridge and is scheduled by H. M. Office of Works as an ancient monument.

In an article on this bridge in a recent issue of *The Steel Constructor*, it is described as a single span structure of 100 feet 6 inches, rising 50 feet above mean water level and with a total length of 196 feet. It consists of cast iron ribs and floor, with masonry abutments. Each of the five main ribs, cast in two pieces, is approximately 70 feet and weighs 5 tons 15 cwts. The floor, which provides a 24-foot carriageway, consists of open sand cast iron plates, 2½ inches thick. The total weight of the cast iron in the bridge is 378 tons.

Construction is now under way on a 27-mile highway connecting Port Said with Damietta, Egypt. The road is being built partly over soft sandy soil, necessitating several layers of large stones as a base on which a bituminous macadam surface will be laid. The first 7-mile section of the road is being built by the Suez Canal Co. and the remainder by the Egyptian Government. The entire project will cost approximately $2,250,000.

Concrete Pavement Crack Survey in Tennessee

During the past several years pavements in Tennessee have been constructed with dummy joints spaced at intervals of 30, 40 and 50 feet and more recently with steel dowels at dummy joints. A survey was made of surface conditions of these pavements with the object of obtaining data regarding the value of dowels and the proper spacing of dummy joints for a satisfactory slab design and was reported on by E. W. Bauman, Engineer of Materials and Tests, Tennessee Department of Highways and Public Works, in a recent issue of *Highway Research Abstracts*. Observations were made on five sections totalling 109 miles.

The five sections included Section A, 24.98 miles of 8-6-8-inch cross section with dummy joints spaced at 30-foot intervals, dowels at the dummy joints and ¾-inch expansion joint spacing every 90 feet; Section B, 6.84 miles of 8-6-8-inch cross section, with dummy joints at 30-foot intervals without dowels and a ¾-inch expansion joint every 90 feet; Section C, 28.5 miles of 9-7-9-inch cross section, with dummy joints at 40-foot intervals, without dowels and with a 2½-inch expansion joint every 320 feet; Section D, 25.5 miles of 9-7-9-inch cross section, and 6.35 miles of 8-6-8-inch cross section, with dummy joints at 50-foot intervals, without dowels, and a 2½-inch expansion joint every 300 feet; and Section E, 17.05 miles of 8-6-8-inch cross section, without dummy joints and with a 2½-inch expansion joint every 500 feet.

All coarse aggregates used were Tennessee River gravel, classified as siliceous cherty gravel. The sand was river sand produced from the same bars from which the gravel was obtained. The concrete was designed for a strength of 750-pound modulus rupture at 28 days. It is thought that sufficient mileage was inspected to eliminate in large measure the effect of variable subgrade conditions.

The survey revealed that Section A had an average of 1.0 outside corner breaks and 0.16 center corner breaks per mile, 181.3 cracks per mile and an average length of unbroken slab of 29.1 feet. Section B had an average of 0.15 outside corner breaks and 0.0 center corner breaks per mile, 186.2 cracks per mile and an average unbroken slab length of 28.4. Section C showed an average of 0.11 outside corner breaks and 0.0 center corner breaks, 146.0 cracks per mile, and an average length of unbroken slab of 36.2. Section D had an average of 0.75 and 7.53 outside and center corner breaks, respectively, 167.5 cracks per mile, and an average unbroken slab length of 31.5 feet. Section E showed an average of 0.94 outside corner breaks, 1.99 center corner breaks, 219.7 cracks per mile, and 24.0 feet of unbroken slab. In compiling this data, the average number of cracks per mile includes dummy joints, expansion joints and cracks developed subsequent to the construction of the pavement. The average slab length was obtained by dividing the total length of the pavement in feet by the number of all cracks, and indicates the sections of unbroken concrete.

Undoubtedly the dowels provided for load transfer from one section of pavement to another, but the damage caused by the improper installation of the dowels outweighed the benefits derived from their function as load transfer units. As regards corner breaks, it is notable that more such breaks occurred in the doweled dummy joint Section A than in Section B pavement without dowels.

From the standpoint of maintenance cost, appearance and riding quality, the pavement with the least number of cracks, Section C, is the most desirable. The fact that dummy cracks contribute a definite control over the ultimate condition of the pavement is shown by comparing Section E with any of the other four. Forty feet appears to be the proper spacing of dummy joints for the conditions encountered in these sections.

Competition for Design Of Elevated Highway

A national competition for the most suitable structural and architectural design of an elevated highway has just been announced by the American Institute of Steel Construction. The competition is open to everyone, except members of the staff of the Institute, including amateur as well as professional designers and architects. One or more designs may be submitted, or two or more persons may jointly be a competitor. The closing date of the competition is March 31, 1938, and no designs submitted after that date will be considered. The first prize will be $5,000, the second prize $2,000, the third prize $1,000 and ten honorable mention awards of $100 each will be made.

The object of this competition is to develop a technique of design suitable to elevated highways. The designs submitted will be judged on their originality, practicability of construction, economical use and arrangement of materials, adaptability to actual conditions, and beauty.

Those interested in entering the competition should notify the American Institute of Steel Construction, 200 Madison Ave., New York City, at once and secure the details of the competition and the regulations for the submission of entries.

Continued Federal Aid Urged for Construction

The allotment of nearly one-third of the $359,000,000 fund authorized by Congress for loans and grants by the Public Works Administration for construction of "moral obligation" projects has been hailed by the Associated General Contractors of America as a signal benefit to the construction industry which, in spite of gains in volume over the past few years, is still lagging behind the levels it attained in the pre-depression period.

"While construction volume is greater this year as compared with the volumes of the past three or four years," said E. J. Harding, Managing Director of the Association, "it is still far below the average volume of the years from 1925 to 1929. According to studies which our association has made, the volume of construction in 1936 amounted to only 59 per cent of the average of those pre-depression years."

The great inportance of the continuation of the PWA program was recognized early in the year by the Associated General Contractors, which found from its analysis of the statistics of the industry that in normal times public construction constituted 31 per cent of the total volume of construction. The financing of public construction in normal times, however, was done mostly by state, county and municipal governments, but in the past few years the financial position of the local governments has made it impossible for them to carry on the amount of construction which they formerly did.

"The early allotment of the funds made available to PWA will go far toward maintaining the public construction volume, while the hoped-for volume in the field of private construction will have an opportunity to build up until it will again approximate the levels it attained in the pre-depression period."

Manual on Maintenance Of Conveyor Belting

A new 20-page booklet on the care and maintenance of conveyor and elevator belting has recently been issued by the B. F. Goodrich Co., Akron, Ohio. This manual contains information on the proper installation, loading and repair of conveyor belts, and data on specifying the proper belting to meet the requirements of the job, with illustrations and diagrams.

Copies may be secured by those interested direct from the B. F. Goodrich Co. by mentioning this magazine.

Chicago Distributor Opens New Building

The R. C. Larkin Co., equipment distributor of Chicago, Ill., has opened its new and larger quarters at 3001 So. Wabash Avenue in a new building designed and constructed specifically to serve the construction industry.

This new building covers an area of 125 x 100 feet and contains a large display room for exhibiting tractors and other construction equipment; a repair parts room, fitted with bins and storage space enabling the company to render prompt parts service on all the lines carried; and a huge repair and machine shop equipped to take care of all rebuilding and service operations. The offices are located on the second floor.

The R. C. Larkin Co. is distributor for Sullivan compressors, Thew-Lorain shovels and draglines, Universal-Lorain crawler and truck shovels and cranes, Allis-Chalmers tractors, Buffalo-Springfield rollers, Baker bulldozers and graders, and Euclid road machinery.

New C-P Branch in Utah

The Chicago Pneumatic Tool Co., of New York City, has announced the opening on September 1 of a direct factory sales and service branch at 119 West Second St., So., Salt Lake City, Utah. Otto A. Ray has been appointed Manager.

Tunnel Problems on Feather River Route

(Continued from page 1)

feet long, Tunnel No. 2 is 390 feet long and the longest, No. 3, is 1,188 feet long. No. 3 has four adits opening to the stream which provide ample ventilation for the bore and also were advantageous for mucking the tunnel during construction. These adits are unequally spaced, being located wherever ravines made the wall of rock thinner, permitting easy access to the face of the cliff. Three of the adits are 30 feet wide and one 40 feet.

The character of the rock is generally good and timbering was not necessary during construction but for the continued safety of the tunnels there are portals for two of them and some sections are lined.

Equipment for Tunneling

Air for the drilling operations was furnished by a battery of compressors consisting of two LeRoi-Rix 460-foot gas units and two Ingersoll-Rand 370-foot compressors with gas-engine power. These compressors delivered air at 100 pounds pressure to a 4-inch diameter Calco Spi-Weld steel pipe laid ahead of the work. In one place it was suspended across the river on a catenary cable at a point where access to the work was impossible along the side on which the highway is located. The men were taken across on a high line at the same place. The 20-foot lengths of this pipe weigh only 75 pounds and were hand packed ahead with one man per length. Special air-tight joints were welded to one end of each pipe length and permitted quick setting up of the line. Another advantage of the large diameter of the pipe was the storage capacity of the pipe itself, permitting the complete elimination of any storage tank for air.

Drifters and jackhammers were used throughout for the drilling with Timken detachable bits. For lighting the tunnel a Kohler 2,000-watt portable lighting outfit was used with 60-watt lights on a 130-volt circuit. Two other 1,500-watt Kohler outfits were also used for supplementary lighting.

Driving the Tunnels

The slightly decomposed or disintegrated faces of the cliffs were knocked off preliminary to driving the tunnels. This was done usually with 20-foot holes spaced 4 to 8 feet apart. Most of the portal excavation was used in fills and the adit excavation was wasted.

On Tunnel No. 1 a center heading was used while on the other two a top heading was used. The center heading on No. 1 was 8 feet high by 14 feet wide and was worked the same as the pioneer headings on No. 2 and 3, described below in detail, except for a slightly different spacing of the holes. After the center heading had been completed the holes for the remainder of the tunnel were drilled radially with 20 in the upper section, 18 in the lower section and 6 down holes. The spacing was such that the holes were 2 feet apart at the line of the tunnel section. The holes were drilled 3 feet back from the face and each row fired before the next was drilled.

To insure the proper spacing of the radial holes a clinometer was devised and attached to the drill. The angle of the drill was shown by the string of the plumb bob and the face of the clinometer showed the depth to which each individual hole was to be drilled.

Top Bench Method

On Tunnels 2 and 3 the center drift method was abandoned and a top bench driven as a pioneer tunnel to permit the shovel to get through to work at the far end and for the approach to the next tunnel. The top bench was 14 feet wide

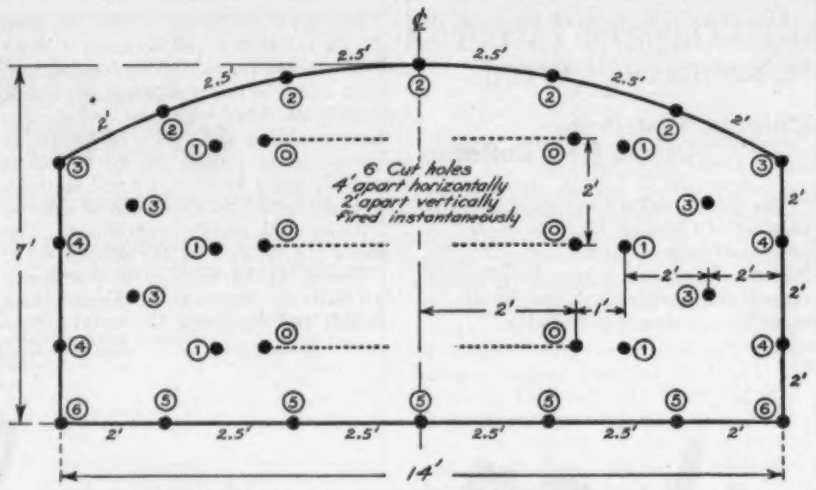


Diagram of Blast Holes for Top Bench of Tunnels 2 and 3

by 7 feet high. It was drilled with 8-foot steel with the holes spaced as shown on the diagram and fired with delays as shown in the circles.

Upon the completion of the top bench a section of the same width and 7 feet high was taken out immediately below. The holes were drilled down for 7 feet on 2-foot centers and 3 feet back from the face. These were shot four rows at a time with delays, opening up the middle bench.

The third step was the removal of the rock at the sides of the first two benches taken out. These side sections were drilled with 12-foot holes, using four holes across the side and two holes at the bottom. This method was used because the rock was full of seams and as much as 20 feet of rock would sheer off at a time. This rock had to be blockholed later.

The final section, the bottom of the tunnel, was removed in the same manner as the middle bench, using 8-foot steel. The drifters for the various sections of the tunnel were operated from 4-inch pipe columns and with 8-foot steel. Four drifters worked at a time with two shifts running each day. Forty per cent gelatin dynamite was used in the tunnel with some 60 per cent for special work.

The tunnels were well ventilated at

(Continued on page 36)

The New Model 20 Hug Lugger

New 8-Yard Dump Truck

A new Model 20 Hug Lugger has been announced by the Hug Co., 716 Cypress St., Highland, Ill. This new truck, according to the manufacturer, embodies all the features of the Model 30 on a smaller scale, with an 8-cubic yard body and an unusually high dumping angle hoist. A complete hoist control makes it possible to hold the truck body at any angle at all times. The entire chassis is electric-arc-welded throughout and power is furnished by a Caterpillar diesel engine.

Complete information on this new Model 20 may be secured direct from the manufacturer.

New Type of Tamper

An explosion-type tamper, weighing 220 pounds and easily convertible to a hammer for driving piles or sheeting, has been announced by the Calhoun Co., 1151 South Broadway, Los Angeles, Calif. This machine is gasoline-operated and is designed for tamping trench backfill, foundations, or small fills and, with the easily interchangeable bases, as a hammer for driving piles and sheeting or for breaking concrete.

The low center of gravity is designed to make this machine easy to handle and it may be controlled with one hand only. It operates on benzol or aviation gasoline, the explosion of this fuel throwing the tamper up about 16 inches, the impact of the free fall producing the blow. Ignition is by a 6-volt motorcycle battery carried on the operator's back and controlled by a push button located on one of the handles. It hops approximately 18 inches vertically and is guided by inclining the machine in the direction desired.

The New Delmag Explosion-Type Tamper

Complete information on this Delmag tamper is contained in literature which may be secured direct from the manufacturer by mentioning this magazine.

Hints on Planting Along Our Highways

Aim of Lower Maintenance Cost and Increased Safety Comes First; Then Natural Aesthetic Effect

By WALTER D. LUDWIG, Highway Forester, Pennsylvania Department of Highways

(Photo on page 48)

THE subject of roadside planting, particularly naturalistic planting known as roadside development, has been misunderstood in the past by many of those both in and outside the work, mainly because roadside development has changed and improved in technique and practice during the past five years. In the Pennsylvania Manual for Forestry and Landscape Practices along the highway system, there is the following general statement as to roadside work:

"The ultimate aim of any roadside development is to cover up construction scars and other man-created situations along the highway in such a manner that the whole highway development blends naturally into the native landscape."

Planting therefore in its broadest aspect is important, but it is only one factor in the larger problem of roadside development.

Purposes of Planting

The principal reasons for roadside planting operations in general may be briefly summarized as follows, in order of their importance: 1. To control washing and erosion, and thus reduce maintenance costs; 2. To control snow and wind, thus reducing snow removal costs; 3. To regulate and direct traffic, such as on center strips, berms, intersections, inside of curves and similar areas, thus improving traffic safety conditions; 4. To furnish some shade and protection to the roadway; 5. To create more favorable public opinion; and 6. To give more aesthetic effect.

While it is true that planting suitable material along the roadway adds to the aesthetic effect, the most important purposes of planting are to reduce ultimate maintenance costs and improve traffic safety conditions. Therefore planting slopes and fills, and snow and wind barriers are the most important and ultimately will result in greatly reduced maintenance costs.

Perhaps equally important are the plantings made to regulate and direct traffic. Proper division of traffic by a center strip, planted with grass, vines or low growing shrubs, is one phase of highway work now in its infancy but which will demand more attention in the future. Some states have already started this work, but most of them have not realized the magnitude nor pressing need for prompt consideration of this problem.

While the planting of shade and ornamental trees is not so important, it is conceded that such plantings do furnish some protection to the road metal as the trees tend to diffuse the summer heat to a certain degree and in winter tend to prevent rapid freezing and thawing, thus giving some protection to the road surface.

Finally there are the plantings for aesthetic effect, but which can be construed as falling somewhat within the previous classifications. In fact, it is almost certain that some other purpose can be given for such plantings and it is recommended that these other purposes of planting be emphasized rather than the aesthetic effect. It is believed that this procedure will have a better effect among highway officials and the

(Continued on page 24)

A Universal-Purpose Jack

The Watson-Stillman standard hydraulic jack, made by the Watson-Stillman Co., 108-140 Aldene Road, Roselle, N. J., is designed to fill the requirements of a universal-purpose jack. It is made in capacities of 10, 20, 30, 40 and 50 tons, with a maximum rise of 12 or 18 inches.

This jack has a horizontal head which enables it to work at any angle from vertical to horizontal, and when laid flat on the side, the ram will push out its entire lifting length. To the bottom of the head is attached a cylinder which passes over the outside to exclude sand and dirt from between the ram and cylinder. A large round steel base furnishes a firm foundation. An independent claw can be used when a low lift is required and removed when the jack is used for other purposes, thus relieving the tool of that additional weight.

Literature describing this hydraulic jack, Bulletin A2, may be secured by interested contractors and engineers direct from the manufacturer by mentioning this magazine.

New Catalog on Asphalt And Oil-Mix Plants

Madsen portable asphalt and oil-mix plants, in capacities of 120, 240, 350, 480, 800 and 1,050 tons, are described and illustrated in new literature recently issued by the Madsen Iron Works, P. O. Box 109, Huntington Park, Calif. These asphalt plants are of unit construction, so that the major sections are easily assembled or dismantled. A feature of these units are the Madsen patented erection jacks which make it possible to erect the entire mixing plant proper quickly and economically without requiring the use of a crane.

Copies of this catalog may be secured by interested contractors and engineers direct from the manufacturer.

Creosoted Guard Rail Posts Used in Wyoming

Creosoted guard rail posts on which all framing and boring were done before treatment were installed on a Wyoming state highway just south of Sheridan, Wyo., last year. The contract, which was awarded to the Northwestern Engineering Co., included placing an oil mat on the roadway surface and the installation of 4,425 linear feet of guard rail.

The rail member is a non-rigid type metal plate, each length of which is kept in tension by helical springs attached to the end posts. The two posts at the end of a section are strut-braced with a heavy timber and anchored by a turnbuckle attached to a deadman to provide a rigid end connection. The rail is of the low type, and the posts are 8 x 8-inch in cross section and 6 feet in length. They were treated with a final retention of 8 pounds of creosote per cubic foot by the empty-cell process, in accordance with standard specifications of the American Wood-Preservers' Association.

After the posts have passed through the proper seasoning period in service they will be painted with aluminum paint. In the meantime, the wide rail member, painted white, makes the rail easily visible.

According to an article in a recent issue of *Wood Preserving News*, preservative treatment of guard rail posts materially reduces the annual cost of guard rail installation by increasing the life of the posts, and also minimizes the danger resulting from breakage, which is frequently traced to weakening of untreated posts at the ground line, where decay usually starts.

New Construction Equipment Distributor in Columbus

Announcement has been made of the incorporation of The Lorenz-Wheeler Co. at Columbus, Ohio, to take over the business of the Lorenz Equipment Co. of that city. Frank J. Lorenz, who established the business about five years ago, states in the announcement that the growth of business has been so rapid that there was urgent need for added personnel and expanded facilities. Vern Wheeler, for many years active in the power shovel and crane field and since 1931 associated with Northwest Engineering Co. of Chicago, has become a member of the company.

The Lorenz-Wheeler Co., located at 547 West Rich St., Columbus, will act as Central Ohio distributor for a number of manufacturers of construction equipment, including the Allis-Chalmers Mfg. Co., Northwest Engineering Co., Sullivan Machinery Co., and Universal Crusher Co.

New Catalog on Welding And Cutting Apparatus

Victor acetylene welding and cutting apparatus, which includes a variety of welding units, regulators, cutting torches, tips, apparatus repair tools, under-water cutting torches, welding fluxes, gloves and welding accessories, acetylene generators, floodlights and flares, is described and illustrated in an 80-page catalog, copies of which may be secured direct from the Victor Equipment Co., Welding Equipment Div., 844-850 Folsom St., San Francisco, Calif., by mentioning this magazine.

The New Adams No. 20 Motor Grader with Snow Removal Attachment

A New Motor Grader For Year-Round Work

The new No. 20 motor grader, recently announced by the J. D. Adams Co., Indianapolis, Ind., is designed for light grading and maintenance work on state, county and township roads, and for snow removal work.

This new Adams grader is powered by an International I-12 tractor with a 22½-hp engine, and a special chain drive between the tractor axle and the driven axle effects a 65 per cent increase in the pulling power of the tractor, according to the manufacturer, thus enabling the grader to do more work than might be expected of a machine of this size. It has all-welded construction, machine-finished ball and socket connections, machined full circle, and other features of the larger motor graders.

Standard equipment includes a 9-foot blade, with 10 and 12-foot blades optional. A new plow, hydraulically controlled from the cab, shown in the illustration, is available for snow removal.

Work on New Bridge Over Miss. River Started

(Photo on page 48)

The construction of the $8,360,528 bridge across the Mississippi River just north of Baton Rouge, La., was started with official ceremonies in August. The bridge, which will be 65 feet above the maximum high water of 1937, will have two cantilever spans, each with a horizontal clearance of 848 feet. There will be a single track railroad across the bridge, on either side of which will be an 18-foot concrete highway. The latter will form a link in the projected 40-foot road from the Mississippi line at Pearlington, Miss., through New Orleans and Baton Rouge and across the Atchafalaya River at Krotz Springs where the highway divides, one road going to Northern Louisiana and the other to the southwestern part of the state.

The length of the main structure of the bridge will be 3,326 feet and the approaches will be 8,900 feet, giving the bridge a total length of 12,226 feet. For the construction of the bridge, 93,000 cubic yards of concrete, 180,000 linear feet of concrete piling, 13,000 tons of carbon steel, 22,000 tons of silicon steel and 2,000 tons of reinforcing steel will be required.

The Kansas City Bridge Co. has the contract for the erection of the six piers, and the Bethlehem Steel Co. will erect the main bridge structure. It is expected that it will be completed in two years.

More New Dealers Appointed by Ransome

The Ransome Concrete Machinery Co., Dunellen, N. J., manufacturer of concrete mixing and handling equipment, has added the following companies to its expanding list of dealers handling Ransome truck mixers and agitators: Edelen & Boyer Co., 236 N. 23rd St., Philadelphia, Pa.; Wm. T. Johnston Co., 214 Vine St., Cincinnati, Ohio; and W. T. Walsh Equipment Co., 3088 W. 106th St., Cleveland, Ohio.

Heavy Construction For Traffic Relief

N. S. Mackie Co. Contract At 47th Street, Chicago, Includes Caisson, Tunnel And Concrete Sewer

(Photo on page 48)

AN important phase in Chicago's program to make its lake front boulevard system safe and efficient requires relief of the traffic congestion at arterial streets that feed into the Outer Drive. The Chicago Park District is accomplishing this at 47th Street by the construction of an underpass, approximately 100 feet wide and 300 feet long, under the Illinois Central Railroad tracks, a complete grade separation at the Outer Drive, and an intercepting sewer. In January 1937 the Chicago Park District awarded the contract for this work to the N. S. Mackie Co., of that city.

Underpass

The new underpass will extend to the east of the present Illinois Central tracks, a distance of approximately 100 feet, taking the project beyond the old shore line of Lake Michigan which has been extended from time to time in the past. The lake shore line was originally where the Illinois Central tracks are now located.

Two pile piers, runing north and south, were within the area where the work was to be done. These piers had been filled and backfilled with stone and there was also an accumulation of rubbish. This stone was removed by a Bucyrus-Erie 42-B crane with a 60-foot boom and a ¾-yard Kiesler clamshell bucket with teeth, the excavation being carried down to clay, which was approximately Elev. -12. It was then necessary to fill in with sand to secure a proper bearing for the concrete footings.

The underpass structure is carried on seventy-six caissons, each approximately 4 feet in diameter, all caissons going to rock. To the east of the railroad the caissons had to go through stone, sand and clay to a depth varying from 40 to 50 feet to insure a good firm rock foundation. The character of the material here was such that wellpoints could not be used, as they could not be put through the stone and rubbish. This difficulty was overcome by driving 2 x 6 maple lagging through the rubbish just outside the caissons. As soon as sand was encountered, 7-gage steel shells were set up, jetted with a high-pressure Fairbanks-Morse jet pump and driven with a No. 6 McKiernan-Terry hammer and a No. 1800 Super Vulcan to about a 2-foot penetration into the clay. The shells were then pumped out with four Thor and one Cleveland 2-inch pneumatic sump pumps. The men digging the caissons used regular standard digging shovels until hard blue clay was encountered and then used Thor, Gardner-Denver and Cleveland diggers.

General View East of the Tracks on the 47th Street Underpass Project During Caisson Excavation, Showing the Mixer and Pumpcrete in the Background

Although expensive at the start, this method proved to be very satisfactory as good progress was made after clay was encountered and the men in the caissons were well protected against accidents.

Another factor affecting operating time is the necessity of doing all work without interference with the railroad.

(Continued on page 31)

Wire Rope Co. Appoints New Dealer in St. Louis

The Broderick & Bascom Rope Co., of St. Louis, Mo., has announced the appointment of the O. B. Avery Co., 1325 Macklind Ave., St. Louis, as its distributor in that city. Avery will carry ample stocks of B. & B. standard construction as well as Flex-Set Preformed wire rope.

Broderick & Bascom's sales and engineering departments are ready at all times to cooperate in the solution of wire rope problems on construction equipment and will be glad to make suggestions to contractors who send their problems to them.

U. S. Engineer To Supervise Road Building in Nicaragua

The Nicaraguan Government has engaged the professional services of G. C. Lassetter, U. S. highway engineer, for a period of four years to work in cooperation with the Government in undertaking economic studies and plans, to teach Nicaraguan workmen how to construct and maintain roads, and to supervise generally the road work in that country, the U. S. Bureau of Foreign and Domestic Commerce reports.

The aim of the Nicaraguan Government is to bring its roads up to the standards of those in the United States, insofar as local conditions and needs permit, and Mr. Lassetter, who was associated with the New Mexico Highway Department from 1921 to 1936 in all types of highway engineering work, will introduce in that country the road-building methods which have made the United States the highway leader.

Equipment Distributors And Whom They Represent

The Associated Equipment Distributors has just issued a list of members and the manufacturers they represent. This reference book of 36 pages, compiled as of June, 1937, by the Roster Committee, Morton R. Hunter, Chairman, is now offered for sale to anyone in the construction industry.

Copies may be secured from A. C. Blaisdell, Secretary, Associated Equipment Distributors, 2143 Barnard St., Cincinnati, Ohio, at $1.00 each.

RIGHT DOWN YOUR ALLEY

Diesel RD4 Tractor with LaPlant-Choate V-plow keeps the streets and alleys clear of snow for the City of Verdun, Province of Quebec. Consumes 1 Imperial gallon of inexpensive Diesel fuel per hour.

WINTER WALKS

A "Caterpillar" track-type Tractor is used by this Michigan city to clear 30 miles of sidewalk every 10 hours. In Summer, the tractor, with a "Caterpillar" Trailer Patrol, maintains streets.

County Grading Program Carried On by Own Force

Cottonwood County, Minn., carried on a 12-mile grading program this summer, all of which was done by force account, using county-owned equipment for loading and grading and rented equipment for hauling.

Most of the grading involved about 12,000 yards of excavation and fill per mile and was done according to plans and specifications, using a 100-foot right-of-way so as to grade a flat shoulder slope as well as a flat back slope. This is designed to provide a road which can be easily maintained, especially in winter.

J. S. Wagnild, County Highway Engineer, also reports that Cottonwood County added one new light truck to its equipment this summer, for general maintenance work.

Protection of Welders

A 28-page booklet "Health Protection of Welders", discussing the various types of welding and the four principal hazards that are encountered has recently been issued by the Metropolitan Life Insurance Co. The four hazards as reported in this booklet are electric shock and burns; radiant energy; gases, fumes and dust; and miscellaneous, including such possible hazards as the exhaustion of oxygen in the air breathed when working in confined unventilated places. Protective measures are outlined and methods of treatment in case of injury are considered.

Copies of this booklet are available gratis from the Policyholders Service Bureau, Metropolitan Life Insurance Co., One Madison Ave., New York City.

New Bridge at Calcutta

Construction has started on a bridge which will at last replace the quaint pontoons familiar to those who have arrived in Calcutta, India, by the Howrah station across the river from the heart of the city. Foundations for the bridge are being sunk 184 feet to get to good clay. Hollow squares of concrete are sunk into the mud by dredging and by their own weight and then are filled up. Head room at high flood will be 29 to 35 feet. The bridge, which will have a span of 1,500 feet, will be completed in 1940.

A Davey Compressor Mounted on an International Truck

New Four-Wheel Drive Trucks and Tractors

The new Oshkosh four-wheel drive trucks and tractors, made by Oshkosh Motor Truck, Inc., Oshkosh, Wis., are claimed to be sturdy, powerful all-around units which are suitable for hauling heavy loads through sand or mud, pulling up steep grades or plowing through deep snow drifts.

The Oshkosh four-wheel-drive principle requires the transmission of power from the engine to the clutch into the transmission, and from there through the sub-transmission to the front and rear axles. All units, including the cab, are mounted on three points, thus allowing the truck to weave freely, eliminating the possibility of breakage caused from binding. The new improved patented front axle and steering mechanism is designed to eliminate hard steering and "shimmy." The entire load on the front axle is carried on Timken taper roller bearings.

The front axles are designed particularly for heavy-duty work. The one-piece front and rear axle housing assures maximum strength with minimum weight. Balanced tractive effort is obtained by delivering equal power to the front and rear units. A load distribution of approximately 45 per cent on the front and 55 per cent on the rear enables both axles to utilize all the power for tractive purposes. Simplicity and accessibility are features of all Oshkosh models. The axles are all full floating with front and rear mountings interchangeable. The entire differential can be removed readily, for over-hauling or repairs.

Complete details on the various sizes and models of these new Oshkosh four-wheel-drive units are contained in literature which may be secured direct from the manufacturer by mentioning this magazine.

Increased Receipts Reported In Czechoslovak Road Fund

Receipts of the Czechoslovak Road Fund, which assist the State Treasury in covering the cost of construction and repair of roads in Czechoslovakia, totalled 16,600,000 crowns (or about $581,000) during March, 1937, a substantial increase of 9.2 per cent as compared with 15,200,000 crowns in the same month in 1936. Combined Road Fund revenues during the first quarter of the current year showed an increase of 3.3 per cent over the first three months of 1936, according to a report from the U. S. Bureau of Foreign and Domestic Commerce.

The higher receipts were derived chiefly from the increased yield of the consumption tax on mineral oils, the motor vehicle tax and the control fees paid for alcohol used in motor fuel mixes.

Compressor Has Long Life

The Davey compressor shown in the illustration, made by the Davey Compressor Co., Inc., Kent, Ohio, was first sold to the Oklahoma Contracting Corp. in 1932 and was at that time mounted on a tractor. After five years of hard usage, the tractor wore out. So the contractor shipped the compressor to the Davey plant where it was remounted on a new International truck on which it is expected to give additional years of service.

White Joins Waukesha

Cecil E. White, formerly Manager of Sales Promotion for the Milwaukee Division of the Standard Oil Co., has joined the sales staff of the Gas Power Division of the Waukesha Motor Co., of Waukesha, Wis. Mr. White, who will assist Mr. Kilpatrick in the promotion of the new automatic power units as well as the Waukesha automatic deluxe gas power units, will devote part of his time to sales work in the field.

The New Frink Snow Plow for Use with Light Trucks

New Snow-Plow Control For Use on Light Trucks

A feature of the new Frink V-type Sno-Plows for use on Ford, Chevrolet, International and other 1½-ton trucks for light plowing and patrol work, recently announced by Carl H. Frink, Clayton, N. Y., is the full power hydraulic plow lift which is available for these models. This hydraulic control provides a positive, rapid means of adjusting the snow plow and leveling wing through easily operated hand levers, which are conveniently located in the cab.

Model 117SP, a light but sturdy unit, is 7 feet wide at the cutting edge, has a moldboard spread of 9 feet 6 inches, is 2 feet 6 inches high at the nose, 5 feet high at the rear of the moldboard and weighs 1,035 pounds.

Model 118SP is similar to Model 117SP, except that it is a foot wider at the cutting edge and slightly heavier, and is recommended for use on 2 to 3½-ton trucks with dual tires for light to medium plowing and patrol work. Both models are available with hand as well as the new power hydraulic lift for the snow plow and leveling wing.

These and other Frink snow plows, including the extra heavy-duty models for use with 7 to 10-ton trucks, are described and illustrated in Catalog No. 37B which may be secured by state, county and township engineers direct from the manufacturer by mentioning this magazine.

New Wheelbarrows And Concrete Carts

The American DeLuxe contractors' wheelbarrow, made by the American Steel Scraper Co., Sidney, Ohio, is so designed and constructed that the load is over the wheel, thus relieving the user of carrying the load. These wheelbarrows are made in three sizes, of 4, 4½ and 5 cubic foot capacities. They are equipped with 16 x 4-inch 2-ply inner tube pneumatic-tired ball-bearing wheels and a double bottom tray, both riveted and welded.

The pneumatic-tired concrete carts, also made by this company, are made in three capacities, of 6, 8½ and 11 cubic feet. These carts, which may be equipped with 44½ x 4-inch diameter wheels or with 31 x 5-inch, are also available with 36 and 42-inch steel and solid rubber tired wheels.

Complete information on this equipment may be secured direct from the manufacturer by mentioning this magazine.

A. I. S. C. Convention

The American Institute of Steel Construction will hold its Fifteenth Annual Convention at the Greenbrier Hotel, White Sulphur Springs, W. Va., the last week in October. General business sessions will be held in the mornings on October 26 to 29, leaving the afternoons free for special forums, conferences and group meetings, an arrangement which has been made for the first time.

The Convention will be preceded by a meeting of the Board of Directors on Monday evening and followed by a meeting of the Board for the election of new officers.

Arc Welding Design Chart Issued in Revised Form

The chart brought out last fall by the Lincoln Electric Co., Cleveland, Ohio, to provide in concise ready reference form the data necessary for producing arc welded designs has been revised, the feature of the new chart being the inclusion of the latest weld symbols adopted by the American Welding Society in May. The adoption of new symbols by the Society is expected to accomplish much in simplifying welded design by making it possible clearly to convey the necessary information from the designer to the workman. The new arc welding symbols, reproduced clearly and with complete explanation on the new chart, provide means of placing complete welding information on drawings.

Data on the chart also includes illustrations and information on the sixteen types of joints for arc welding, illustrated suggestions for better arc welded design, sketches explaining the nomenclature of welds, and other valuable information.

This chart is 24 inches wide by 35½ inches high, with a metal strip across top and bottom and a clip at the top for attachment to the wall. Copies of this chart are available gratis from the Lincoln Electric Co., Welding Engineering Dept., Cleveland, Ohio.

New Sand Pump Catalog

Model 100 sand pumps for smaller capacity requirements, designed and manufactured by the Kimball-Krogh Pump Division of the Victor Equipment Co., 1010 E. 62nd St., Los Angeles, Calif., are described and illustrated in a new bulletin No. 100 recently issued by that company.

The catalog contains line-drawing cross sections, tabulated parts, price lists and speed tables. Text has been reduced to a minimum, with chief emphasis on the Victor wear take-up adjustment and specific illustrated directions therefor.

Copies of this new catalog may be secured direct from the manufacturer by mentioning CONTRACTORS AND ENGINEERS MONTHLY.

Truck Operation Costs Show Unexpected Items

"It's not the first cost, it's the upkeep" has become practically a byword, applied to everything from automobiles to wives. Its frequent use has in no way affected the truth of the statement and a detailed analysis of the whole subject of motor truck accounting, completed by the Autocar Co., has shown that the first cost is relatively unimportant and that the very important cost of operation has been neglected by all too many truck owners.

The cost of a truck is reflected in depreciation and interest, which together amount to only 12.25 per cent of the total annual outlay. Drivers' wages and gasoline, on the other hand, represent 56.80 per cent and are roughly the same for all trucks of similar capacities, regardless of first cost, according to the Autocar survey. Parts, tires, repairs, oil and so forth are items which are affected by the engineering and design of the truck, as well as by its maintenance or lack of it.

Elements of truck or tractor operation cost, in order of their size, are found by the Autocar study to be on a percentage basis:

Item	Per Cent
Drivers	35.47
Gasoline	14.69
Depreciation	11.23
Parts	7.25
Insurance	7.13
Gasoline taxes	6.64
Tires	5.03
Repair labor	4.12
Housing	3.05
Oil	1.53
Taxes	1.28
Interest	1.02
Supplies (chains, tools, etc.)	.87
Grease	.52
Painting and washing	.17

A model form of truck accounting, so that truck owners may know precisely what their truck operation costs are and whether or not they are getting economical performance from their truck fleets, has been prepared by the Autocar Co., Ardmore, Pa., copies of which may be secured by interested truck owners direct from that company by mentioning CONTRACTORS AND ENGINEERS MONTHLY.

The Use of Tractors In Snow Removal Work

The features of Cletrac tractors which make them adaptable for use in snow removal, including easy starting in subzero temperatures; effective traction in ice, hard or soft snow; enclosed mechanism protected against snow and slush; easy handling; power to buck drifts and simplicity of maintenance, are described in a new booklet "Cletracs for Snow Removal" just published by the Cleveland Tractor Co., Cleveland, Ohio.

There is a Cletrac for every type of snow removal job, in six sizes and fifteen models from 22 to 94 hp, with gasoline, tractor fuel or diesel power. The electric starting on all Cletrac diesels, the clearance necessary when working in snow, the heavy crankcase guard, all-metal weatherproof cabs, buffer springs, head lamps for lighting the work when necessary and the dead axle shaft for mounting snow plows are described and illustrated.

Copies of this booklet may be secured by interested state, county and township engineers direct from the manufacturer by mentioning this magazine.

Lily Eradicator For La. Bayous

Mechanical Destruction Of Water Hyacinths Now By Floating Crusher Of U.S.E.D.

(Photo on page 48)

THE water hyacinth which infests bayous, lakes and canals in Louisiana impedes navigation of these waters to such an extent as to cause costly delays to shipping and require ceaseless effort on the part of the Government to keep the streams open. The U.S. Engineer Department has fought this pest with a poison spray for many years but because of the hazards involved in this method of destruction, the need for some more suitable means of combatting the pest was evident. Now a unique floating crushing plant has been designed to destroy the troublesome water growths.

The water hyacinth is an unusual plant in that it does not root on the bottom or sides of a waterway but floats freely in the water, supported by numerous bulbs or balloons of air varying in size from a small walnut to a hen's egg. The new floating hyacinth destroyer operates on the principle that if these buoyant sacs are crushed the plant will sink and die.

The "Kenny", the new hyacinth destroyer, was built for the First New Orleans District, U.S. Engineer Department, by the Equitable Equipment Co., Inc., of New Orleans. It consists of an all-welded steel hull, 80 feet long, 24 feet wide and 4 feet deep. The hull is of the conventional twin-screw tunnel type connected through reduction gears driving a 26-inch diameter, 22-pitch propeller. Power for propulsion is furnished by diesel-electric drive from two Winton diesel engines of 125-hp each, direct-connected to 80-kw direct-current 250-volt electric generators. The propelling motors are 25-hp each. The cruising speed of the plant is approximately 5½ miles per hour.

The bow of the barge is equipped with gathering guides which can be adjusted to any desired angle to cause the water hyacinth plants to flow onto the three independent sections of conveyors which extend about 2 feet under water. Each section of the conveyor, which is controlled by a lever on the bridge of the barge, is 5 feet wide. The prongs on these conveyors pick up the lilies and carry them to a bin directly over the crusher which collapses the buoyant sacs. The crushed plants are flushed overboard and sink to the bottom. The crusher capacity is 3,600 square yards per hour with an average depth of 2 feet of vegetation. The capacity of the plant is believed to be about 1,000,000 square yards of lilies per month.

It is not yet known whether the seeds of the plant will be completely killed by the crusher. If they are not killed, some method of complete removal of the plants will be necessary, to which the collecting and crushing equipment on the "Kenny" will be a most valuable adjunct. In this case and also if the rotting of the large volume of organic matter at the bottom of the waterways creates a nuisance, it may be found necessary to deliver the crushed water hyacinth plants to another barge, dry the plants in the sun and burn them.

The "Kenny," which has a crew of ten men, was built at a cost of $100,000, and was named in honor of the late Captain M. F. Kenny, a pioneer lily destruction expert who died from arsenic poisoning.

Simplified Joints For Concrete Roads

Effective Joints Are Well-Supported at Forms and Pegged to Subgrade at Four Places with Heavy Pins

CALIFORNIA is using a simple and effective expansion joint easily installed in portland cement concrete pavements. This is in contrast to the more and more complicated joints that some of the eastern states are attempting and which will inevitably result in higher bids for the work unless the contractors are stupid enough to continue bidding the same price for the new joints as for the old. Enough for the East; here is a description of the joint that the Golden State of the West is using as standard.

Expansion Joint Material

Premoulded expansion joint material, composed of a durable resilient compound of mineral or vegetable matter, is used ½-inch thick, supported during pouring by a joint protector of sheet metal extending to the grade on the side toward the paver and down 4 inches on the far side. Both sides of the protector are cut with V slots for the insertion of the dowels, nine of which are generally used in a 10-foot strip of concrete, spaced 14 inches apart.

The joint protector is held firmly in place against any displacement by the concrete. Four eyes are welded to the protector and hooks or anchor bars 30 inches long fitting the eyes closely extend back to heavy pins driven into the grade. These are pulled with picks when the concrete has been placed on both sides of the joint and the finisher has made several trips over the joint.

End clips of galvanized sheet metal are attached to both ends of the premoulded material with wings flat against the forms. When another slab is to be poured alongside the first, these wings are bent back and hold the expansion joint of the second slab in correct alignment with the first. To prevent cutting of the joint, which is only ½ inch below the top of the slab, by the flange of the finishing machine wheel a "joint frog" is clamped to the form at the expansion joint. These frogs project down the face of the side forms with a clamp on the outer face and a slotted inner face to fit over the joint filler. A similar frog is used on any adjacent concrete slab but without the clamp.

Dowels

The dowels holding the two slabs in line are ¾-inch by 2 feet with a 3¼-inch cap on the end toward the paver and inserted in the end of the cap is a standard ¾-inch cork to take up the expansion without damaging the concrete. The dowels, which are at the mid-depth of the slab, are held firmly in a horizontal position by tying to a transverse ½-inch square deformed bar at both ends of the dowels. Four chairs, one at each end and one 3 feet from each end, hold the transverse bars in position. A form of chair used with success is simply a piece of galvanized metal bent to a V and cut for a short distance along the fold and spread to give the bearing on the subgrade. It is slotted at the top so that it can be threaded onto the transverse bar. A slight offset at the top made by a slit across the fold provides a space for a pin to hold the chair in place in the subgrade.

C. & E. M. Photo

Set-Up of One of California's Simplified Expansion Joints

Finishing

After two or three passes of the finishing machine the anchor arms and the joint protector are pulled and a ¾-inch equal leg cap is placed on the premoulded material until the floating is completed. It is removed by the finisher.

Pneumatic Equipment For Construction Jobs

A new 60-page catalog, describing and illustrating Thor rock drills, paving breakers, clay diggers, pneumatic sump pumps and accessories, has just been issued by the Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill. Complete information and specifications for the entire Thor line are given.

Copies of this new Catalog No. 41 may be secured by interested contractors and engineers direct from the manufacturer by mentioning this magazine.

The Binks No. 37 Road Striping Outfit

New Road Striping Outfit

The Binks No. 37 road striping outfit, made by the Binks Mfg. Co., 3114 Carroll St., Chicago, Ill., is made in two styles of mountings for the rear end of a truck or for mounting on the running board. The outfit consists of the striping shields, automatic spray gun, hand valve, and necessary hose and connections.

In the trailer type, the upright mounting post with an adjustable clamp for various heights is bolted to the truck floor. A special spring tension joint frees the outfit from truck jars and the rubber tires absorb road bumps. The hand-operated valve can be mounted in any position convenient for the operator. The compressor should be at least 3 hp and is usually mounted on skids to prevent moving from side to side in the truck. For average needs, a tank of at least 15-gallon capacity or larger is recommended. The automatic spray gun is mounted between two metal discs and the spray is so directed as to insure a uniform stripe. The discs are adjustable from 4 to 6 inches in width. The spray gun itself is adjustable and can easily be removed from the machine for inspection or cleaning. The gun is opened and closed by the truck operator by a hand valve.

The running-board type is the same unit, so arranged that it can be mounted on the running board of the truck. The operation of the striper with this type of mounting permits traffic to carry on as usual. The unit can be attached to either side of the truck.

Where the striping crew goes from one location to another, the outfit for either type of mounting can be lifted off its wheels by a chain or rope, thus allowing the truck to drive at regular speed from job to job.

Design of Asphalt Mixtures For Underwater Construction

The progress made in devolping asphalt mixtures for mass construction above and below the water line, with especial reference to jetty work in the United States, was described in a paper "The Design of Asphalt Mixtures for Underwater Construction" presented by McCrone and Field, of the U. S. Division Engineer Office and The Asphalt Institute, respectively, at the Fortieth Annual Meeting of the American Society for Testing Materials.

Underwater construction presupposes conditions completely dissimilar to those encountered in asphalt pavement work and the paper attempts to show the purpose of the structures for which asphalt mixtures for underwater placement have been devised. Composition of mixtures materially different from those used for pavements is indicated. They should be mixed and placed at relatively high temperatures, 450 degrees F., but the completed structure probably will meet a narrow range of temperature, from about 32 to 80 degrees F. Impact as conceived in pavement design is not a factor. Mixing, handling, placing and compacting asphalt mixtures in great masses under conditions met with in underwater construction involve new methods and equipment not yet fully developed.

Copies of this paper may be secured from the American Society for Testing Materials, 260 South Broad St., Philadelphia, Pa.

Snow Plowing May Be Life or Death Matter

How an American Model E V-type snow plow mounted on a 5 to 6-ton truck, owned by Brown County, South Dakota, opened up miles of badly snowed-in highway to allow a doctor to get through to an isolated farmhouse where a woman lay critically ill and in need of immediate medical attendance is related in the new catalog of the American Hoist & Derrick Co., St. Paul, Minn.

Other information in this new catalog SNP-1 includes a complete description of American V-type snow plows and wings for trucks up to 10-ton capacity as well as American moldboard Speed plows. Copies many be secured by interested state and county highway engineers direct from the manufacturer by mentioning this magazine.

One of the Five GMC Trucks Dumping Its Load at the Entrance of the Marin Approach Tunnel to the Golden Gate Bridge

Trucks Played Their Part At Golden Gate Bridge

The construction of the $2,000,000 Waldo approach to the north end of the Golden Gate Bridge was one of the several major construction jobs involved in this gigantic project. This approach involved a four-lane highway 3½ miles long with a 66-foot roadbed, connecting the bridge with Redwood Highway, and the construction of a 1,000-foot tunnel through the Marin hills.

The surfacing material for this approach was hauled by five GMC T-46 trucks with 4-yard dump bodies from a mixing plant 7 miles away. The contractor adhered so closely to his schedule that the last load of surfacing was dumped in place the day before the bridge was opened.

The Golden Gate Bridge is the longest single-span bridge ever constructed, having a length of 4,200 feet. The total length, including the two approach roads, from Waldo Point in Marin County to the Presidio in San Francisco, is 7 miles.

Mix-In-Place Road Builder

A new self-propelled road-mix machine for heavy re-treads and stabilized base up to 9 inches in depth uncompacted, by means of one-pass mixing in place, has recently been developed by the Jaeger Machine Co., 701 Dublin Ave., Columbus, Ohio.

This new Model MP-2 Road Builder is a combination of two units, a twin pugmill mixing unit, complete with gathering plows and screws, storage tanks and pumps for applying binder while mixing, and a spreader-finisher unit, consisting of an adjustable strike-off mounted on 21-foot long floating straight-edge runners which equalize surface irregularities and lay out a smoothly finished surface ready for rolling. Heavy-duty crawlers, driven by a 130-hp engine and steered by individual clutches, propel the machine at speeds consistent with the volume of material being mixed. With single windrows of 8 to 9 cubic feet per longitudinal foot of road, approximately 70 cubic feet per minute can be gathered, mixed and spread at a forward speed of 7 to 8 feet a minute. Smaller windrows are handled at proportionately higher speeds, all in one pass.

Either windrowed material or earth taken direct from the grade after preliminary scarification may be used. The gathering plows have a spread up to 11 feet and are adjustable so that, when gathering material direct from the scarified grade, the operator can cut to exact grade by holding the plows to the staked grade line. When gathering windrows from an established subgrade, the plows are allowed to float free on sliding shoes following the subgrade. Helical gathering screws gather the material into the pugmill at a constant rate of speed.

By means of two pumps driven by an auxiliary engine, the binder material is loaded, while traveling, from tank trucks into storage tanks on the Road Builder and then pumped direct into the pugmill in accurately measured amounts. The use of storage tanks with a combined capacity of 550 gallons provides a reserve of binder material while waiting for the next tank truck to come along. At the rear of twin pugmills, a two-way spreading screw controls the distribution of material to the strike-off, which is maintained at an average level by the long floating runners on which it is carried. Lanes of 9 to 10 feet are so spread and finished, with provision on the machine for blending joints between lanes. Where immediate laying out of the mixed material is not desired, this finishing unit can be removed and the material left in windrows.

Engineering Astronomy

"Every civil engineer should be trained, or should train himself, to map accurately an area 20 miles square or more in an unexplored territory. This work should consist of four fairly distinct parts: 1. astronomical observations on at least one station for azimuth, latitude and longitude; 2. triangulation; 3. leveling; and 4. topography," says J. H. Service, Assistant Professor of Mathematics and Physics, Michigan College of Mining and Technology. In his new book "Essentials of Engineering Astronomy," Professor Service, who was formerly associated with the U. S. Coast and Geodetic Survey, has presented his subject from the point of view of the practicing civil engineer who puts the burden of his work, not on highly developed instruments of extreme accuracy, but on a good transit and watch.

The book is arranged in two parts, the first covering the fundamental principles of spherical trigonometry and astronomy, and the second, actual practice, presenting an observing and computing technique which insures accuracy and speed. Copies of this 167-page book may be secured from Prentice-Hall, Inc., 70 Fifth Avenue, New York City. Price: $2.50.

Grading for N. Y. Concrete Paving Job

(Continued from page 2)

material was laid down were 1½ on 1. The blue clay flowed down to make most of the fills 2 on 1 while the 1½ on 1 was maintained in the cuts.

The material in the fills was spread by a Caterpillar Sixty diesel tractor and a Cletrac tractor, both equipped with bulldozers. The fine grade material was spread with two 10-foot Rome graders with Cletrac power.

Base, Fine Grade and Forms

A 6-inch layer of rolled gravel was spread over the entire sub-base and rolled with a 10-ton Acme gas roller. Over this the 8-inch uniform thickness 10-foot concrete strips were placed.

Just ahead of the forms, on the fine grade, were one Rome grader, a Buffalo-Springfield 10-ton roller with operators, the foreman and three or four laborers, followed by one form-setter with a helper to each line of forms, placing and driving the pins, after which they went back and lined them up. Following was another group consisting of four laborers and a grade scratch-board and a 5-ton roller.

The man who oiled the forms also set up the "pancake turner" joint support required by the 1936 specifications in New York State. This consists of a handle about 10 inches long with a lug on the end to tie it to the concrete, then a short vertical section adjacent to the premoulded expansion joint about 2½ inches long, and then running beneath the joint in a notch is the base or shovel section which is covered with a sheet metal cap extending 2 inches beyond the end to permit expansion. One-inch premoulded Servicized joint delivered notched for the ten-joint supports was used and spaced 91 feet apart.

Paving and Curing

One man dumped the batches in the skip of the MultiFoote 27-E paver where they were mixed 1 minute and 23 seconds before the operator dumped the batches into the bucket. One man with a scratch-board pulled by hand worked immediately behind the paver, giving the grade a final checking to be sure that there were no ruts caused by the batch trucks which hauled on the grade. He also sprinkled the subgrade. There were four puddlers and two men spading at the sides. These last two men carried in the spot-welded mats from the shoulders which were placed by the puddlers.

Immediately behind the concrete crew came the Ord finisher with its operator and then the hand finishers. The two finishers used a 16-foot longitudinal float, making three passes over the slab, the first two using the longitudinal float in the conventional manner of the midwest states where it was developed and has been used so successfully, and on the third pass it was used merely as a strike-off. High and low spots in the slab were adjusted by 4-foot long-handled floats. These same men lifted the expansion joint caps to loosen them from the concrete.

Behind these two finishers came one man who used a 10-foot straight-edge for checking and then used it as a drag straight-edge if necessary to mark high spots which were then removed by the long-handled floats. This man edged the forms and the joints and removed the joint caps.

Curing was by the Hunt process with one man using the power spray gun and applying a uniform coating of the blended asphalt to the surface of the concrete. The slab was opened to traffic after ten days. A man working at night pulled the pins from the forms and then the first thing in the morning two men with a truck picked up the forms and hauled them forward. They hauled all joint material and did the

(Continued on next page)

Widening and New Concrete Paving

(Continued from preceding page)

general work of a utility truck and crew.

Batching

The batching plant was a 1.8-mile dead haul from the south end of the contract. It was set up in a railroad yard but the crushed gravel was hauled in by truck. The sand came in by gondola car and was unloaded with a Northwest crane and a 1¼-yard Williams rehandling bucket. One man spotted the bucket in the car and did the hand clean-up work.

The crane loaded the Johnson bin from which one man batched the dry weights of 2,268 pounds of stone and 1,365 pounds of sand. Immediately beyond the aggregate batchers was a Butler cement bin. Cement from the Allentown Portland Cement Co. was delivered in hopper cars which dumped to a track pit. A horizontal screw conveyor carried the cement to the bucket elevator which raised it to the bin. The batch trucks backed under the aggregate batcher and ran through under the cement batcher. There was a minimum of eight trucks on the short haul and twenty for the long haul. They were all hired 2-batch trucks.

Water Supply

Water for this job, which began at the north city limits of Utica, was purchased from the Consolidated Water Co. which supplies the city. Inasmuch as there was a 600-foot rise in the highway from the point where a hydrant was tapped, two booster pumps were installed, the first a Domestic triplex and the second a Worthington triplex. They pumped through 3½ and 2-inch pipe with paver hose valves installed every 300 feet. The paver carried 175 feet of hose on a boom which spanned the section of roadway over which the batch trucks drove.

A heavier reinforced mesh was used in 8-foot sections at the joints while the standard mesh was 16 feet long. The mesh was placed 2 inches from the top after the concrete had been struck off by the two spaders using a hand drag. As the job progressed the contractor installed a mechanical strike-off which rode on the forms and was pulled by cables on the paver hoist. This outfit poured an average of 150 feet per hour and 1,100 to 1,200 feet for the 8-hour shift. The best day was 1,300 feet.

Experimental Slab

This contract was a designing engineer's heaven inasmuch as there were fourteen different mixes with six different kinds of portland cement and then the same portland cement without the natural cement. In addition they used any one of the portland cements with 10 bags of cement per batch and less sand and stone for high-early-strength. This made an approximate 1:1:2½ mix while the regular mix is approximately 1:1¾:3½.

Three 8-day and three 28-day cores were taken from each of the blocks poured with the fourteen cement combinations. These cores were properly numbered and sent to the Testing Laboratory at Albany. Each block of pavement was marked so that at a glance the mix and materials in the block can be identified at any future time.

A novel sight on this job was two men filling wide cracks in the old 16-foot pavement with a thick grout from standard hand bituminous pouring pots with slotted nozzles. This was to prevent the fine-aggregate bituminous macadam from entering the cracks and causing a similar depression in the surface of the top bituminous course for the first 2½ miles of the contract.

Personnel

This contract of the Dale Engineering Co. of Utica, N. Y. was awarded on its bid of $348,754.10. A. E. "Pete" Portner was Superintendent for the contractor and W. Stanton Gray was the State Engineer in Charge for the New York State Department of Public Works under L. D. Brownell, District Engineer, District No. 2.

New Electrically-Heated Bitumen Weigh Bucket

A new electrically-heated weigh bucket for use in bitulithic mixing plants has recently been announced by the Easton Car & Construction Co., 10 E. 40th St., New York City. The feature of this bucket is the electrically-heated valve of the rotary sleeve type extending the entire length of the bucket. A quarter turn of the handle opens the valve and permits the contents to spray over a wide area of the mixing tank. This is designed to insure a more even coating of the stone than is possible with manually-dumped buckets, according to the manufacturer.

The material as it flows from the bucket passes over and around a heated pipe. The side walls of the bucket are also heated, to insure a clean discharge. While this device was designed for use in conjunction with the Easton-Clarmac electric system of heating bitumen, it is readily adaptable to any plant producing bituminous mixes. It uses 110 volts, either alternating or direct current, and requires no thermostatic devices.

Bulletin 101 describing this new bucket may be secured by interested contractors direct from the manufacturer by mentioning CONTRACTORS AND ENGINEERS MONTHLY.

Roadside Planting In Pennsylvania

(Continued from page 7)

public until such time as highway development is recognized as an integral and necessary part of highway construction, operation and maintenance, and as such will be entitled to proper recognition.

Materials and Procedure

In conducting a study of plant materials, including grass seed for ground cover, it has been found impossible to standardize this material because of varying conditions of climate, soil and other features peculiar to various sections of the country. However, some general principles are outlined as follows as a general guide in such work:

1. Native material should be used as far as possible. The Landscape Engineer should have a complete survey of the location of such available material and should use it on his projects. It is recommended that each state prepare a list of material suitable for the state, following the classification recommended by the Bureau of Public Roads.

2. The use of exotics or materials not native is not recommended, unless it is certain that such material will give satisfactory results and will blend in with the native landscape. Only actual experimental work will determine this question for each state.

3. Native sod, while expensive to place, has given satisfactory results at important locations where the initial expense is warranted.

4. Grass seed can not be standardized except for certain areas or sections. It is advisable to develop three or more formulas for such seed and use them as indicated for the local situation. In some cases, where a quick cover is desired for protection, rye, oats, wheat, cowpeas and similar crops have been used successfully but a permanent cover must be provided later. A nurse and soil improvement planting of black locust or moss locust has been used successfully in Pennsylvania with the result that the planted areas have been reclaimed with desirable native growth within three to five years. All grass seed should be rigidly tested by state or other authorities to see that it meets specifications, especially for germination and purity.

5. Care should be exercised to use species of plants which will require a minimum of maintenance, because in the final analysis, reduced maintenance costs are the desired result. Native vines or low ground cover plants are generally recommended.

6. In many cases it is advisable to supplement the plant material with other structures, such as native stone walls, riprap work and sometimes steel and concrete. Where there is great danger of washing and erosion, the use of these extra materials in the first place will be found most economical and satisfactory, and more than warrant the increased initial expense.

7. Where noxious weeds tend to occupy slope or fill areas, it is not recommended that these be pulled out by the roots, but rather cut them off close to the ground before they seed. Such cutting will not disturb the stability of such areas and will give the native plants a chance to develop and establish themselves. When such noxious weeds must be controlled to protect agricultural land or because of local regulations, chemical or mechanical processes may be employed, but the Landscape Engineer must determine the most satisfactory process for his state or area and how far such eradication work should proceed.

8. More consideration should be given to general mowing practices. In a few states, such operations are under the direction of the Landscape Engineer, but in most states this work is a part of maintenance and the results are generally unsatisfactory. Even though cooperation may exist between the maintenance organization and the Landscape Engineer, serious mistakes are bound to happen. The Landscape Engineer can perform such work more satisfactorily and also at less expense so that a more natural and attractive roadside will result.

9. The use of nursery-grown plant material or collected stock, and the establishment of highway nurseries for the purpose of conserving surplus collected or nursery-grown materials are questions which must be decided by each state. Where ordinary highway labor must be used generally, it is believed that best results will be had from nursery-grown material. Where labor can be selected and properly directed, collected stock can be handled successfully. Connecticut has established some half dozen small nurseries as storage points where native roadside material is conserved for future use. Pennsylvania has one large nursery of 102 acres, centrally located, where native material is conserved and propagated. However, great care must be observed in the establishment of such nurseries so that they do not compete with commercial growers and thereby antagonize these interests. Highway nurseries should be considered only as conservation or storage reservoirs for native material saved along the roadside, or for surplus nursery-grown material purchased from commercial nurseries. In Pennsylvania, the highway nursery material is propagated at a cost of one-quarter of the lowest competitive bid from commercial nurseries, but it produces only about half of the planting material required.

10. The size and quality of planting material to be used can not be standardized but must be determined by the accepted and proper landscape practices for each state or locality, or by the special condition of the particular site. However, the standard specifications, procedure and nomenclature adopted by the American Association of Nurserymen should be used in making up roadside planting plans.

11. The technique of spacing, fertilization, top-soil and other details can not be standardized but must be determined by the Landscape Engineer for his lo-

cality. It should be emphasized, however, that initial plantings should be studied carefully so that they will be as successful as possible. The general public is quick to notice planting failures along the highway, and to criticize. Therefore the proverbial "stitch in time" is highly recommended for general planting technique.

12. Actual expenditure for planting and planting materials is a variable factor and only broad generalizations can be given. According to the U. S. Bureau of Public Roads, from 60 to 75 per cent of the funds allocated to such work should be spent on preparation for planting, including proper grading and laying back of slopes and fills and other necessary work. Proper grading back of slopes and fills should be a part of construction, as it now is in many states. However, in other states, such work must be done as a part of the roadside development program and completed preparatory to planting operations. The extent of this work depends on local factors. Wide right-of-ways usually assure better and more uniform procedure while narrow right-of-ways necessarily limit the scope of such work.

Choice of Materials

The choice of plant materials as one of the factors in a well-rounded roadside development plan is important enough to warrant close and careful study. It is advisable to consult with state or federal officials, colleges and similar interests concerned, so that advantage may be taken of their experience as to the plant material, suitability of various soils for certain species, and the necessary artificial aids to be applied to insure proper development and growth of the plantings.

Nature herself furnishes the best and most reliable guide for this work, and if the planting work follows this lead, it will be a success. When those using the highways can not determine what has been planted and what is natural, when it is impossible to differentiate between the man-created situations and the natural landscape, then roadside planting has achieved its goal that the whole roadside development blend naturally into the landscape, thereby enhancing the beauty of nature instead of diminishing it.

From a paper presented at the Sixteenth Annual Meeting of the Highway Research Board.

Hot-Mix Resurfacing 5-Mile Job in Utah

(Continued from page 2)

to be sure that it was of uniform density when worked by the screed. One raker was kept at either end of the screed to keep the edge uniform and to compact the material with the back of the rake. Metal strips ⅜-inch thick were laid along the forms to allow for the material which was needed for the compression of the hot mix.

Usually the crew laid top from the start of the day until 2 P.M. and then shifted to the leveling course for the balance of the day. Four extra men were kept on the sidelines to substitute for the men working in the hot mix from time to time during the hot weather. This proved a good investment as the men lasted much longer at the work. The material was put down at 270 to 300 degrees. Because of the excessive heat of the sun which prevented the material from cooling as rapidly as usual the contractor was forced to wait as long as two hours before rollers could be put on to the surface. During all the work, which was in a dusty region, the contractor kept a watering wagon running along the sides of the road laying the dust as traffic was permitted to use the shoulders throughout the duration of the job.

The surface was given three rollings, each of a distinct character to leave a perfectly smooth surface. The first rolling was with the 3-wheel 10-ton roller used for the leveling course as well. This was used longitudinally. Then came a 10-ton Austin tandem roller working diagonally. Then, if any high spots were found, the tandem was sent back and rolled transversely at right angles to the center line of the road. Fiber mats on the large rolls of the road rollers were kept wet to prevent picking up of the hot asphalt.

The theory of the right-angle rolling is interesting. It is stated that the roller of the usual machine is in contact with the roadway for only about 2 inches. Thus if there are some irregularities of that length in the pavement they will not be removed by the longitudinal rolling. That will leave a series of small waves which will be closed somewhat by the diagonal rolling, but far better by the direct rolling on the crests of the waves accomplished by right-angle rolling. Theory or not, the state highway engineers have done it in competition with other methods of rolling and have come out with fewer irregularities than with rolling by any other method they have tried.

After the rolling was completed, traffic was permitted to use the roadway, thus taking it off the shoulders so that they could be completed. The forms were pulled and the shoulder trench backfilled with the windrowed shoulder gravel. Before the traffic was turned on finally, a squeegee seal coat was applied. The surface was hand-swept and then the hot asphalt poured over the surface, hand squeegeed and ½ to ⅛-inch stone spread from a truck, bladed with a light patrol grader, touched up by hand brooming and rolled with a tandem roller to key the light stone to the surface.

Personnel

This 5.109-mile resurfacing contract was awarded to Olof Nelson of Logan, Utah, for $106,545.42. It was completed under the direction of his son, Carl Nelson, with W. H. Stietler as Plant Foreman. For the Utah State Highway Commission the work was in charge of F. B. Haynes, Resident Engineer, with Rex Sutherland as Plant Inspector.

You can't afford to miss the ARBA Convention and Road Show in Cleveland January 17-21, 1938.

Welded Culverts Pass State and County Tests

The recent adoption of the oxy-acetylene process by a manufacturer of corrugated culverts has resulted in substantial reductions in special shape culvert manufacturing. Both the bronze-welding and steel fusion welding processes are used successfully in the fabrication of mitered turns, branch fittings and specials of all sizes and shapes. The company which has developed this work makes a specialty of special corrugated pipe assemblies, primarily for state and county highway departments. Corrugated culvert requirements for a large number of Federal projects have also been handled by this company on a contract basis, covering the entire installation including the long lengths of straight culvert piping as well as the special sections.

The base material of the culverts is usually galvanized steel with a heavy coating of spelter. At the present time, two grades of steel are used to a considerable extent. One of these is an almost pure iron. The other is a copper-bearing molybdenum iron. The specials are made up in various sizes from 8 to 36 inches in diameter. The wall thickness for most of these averages 14 to 8 gage. On the copper-bearing galvanized iron, high-strength bronze-welding rod is used. For work on the straight iron material, a good quality of drawn iron welding rod is found preferable.

Two welding operators and one helper in the shop alternate on working with the flame and laying out the various specials with the permanent templates that they have developed, most of them in accordance with the directions in the booklet "Fabrication of Oxwelded Piping" published by the Linde Air Products Co., 205 E. 42nd St., New York City. In making up these templates, however, it was found that because of the relatively large diameter, the corrugations and the relatively thin walls of the pipe materials with which they are working, it was necessary to vary the lengths of the ordinates and other factors in the template design.

For the past two years, culvert specials have been made up according to this method. While none of the specials have been in the ground long enough to give a thoroughly sound test for corrosion resistance, strength and other features, there have been no complaints received in any case. The company feels that the work is quite satisfactory, since it passes all of the tests which Federal, state and county specifications require.

Contractor Finds Market For Ready-Mixed Concrete

An interesting example of cooperation between manufacturer and contractor, resulting in mutual benefit, recently occurred in West Palm Beach, Fla. An analysis of the construction field and its possibilities in that community by the Blaw-Knox Co., 2067 Farmers Bank Bldg., Pittsburgh, Pa., had revealed the need for an additional ready-mixed concrete plant and a fleet of truck mixers. These facts were presented to the Burnup & Sims Co., a contracting firm of West Palm Beach. In order to achieve a satisfactory and profitable relationship between all parties concerned, the local lumber dealers were consulted and arrangements made for them to act as sales agents for the ready-mixed concrete to be produced in the new plant of Burnup & Sims.

A Shipment to Burnup & Sims, Contractor, West Palm Beach, Florida, of Two Blaw-Knox Truck-Mixers and a Hopper and Weighing Batcher, in the Third Truck, for Its Ready-Mixed Concrete Plant

This led to a productive sales effort and a definite increase in the amount of ready-mixed concrete sold. The new batching plant, which had been sold and erected upon this basis, was a commercial success, eventually requiring additional truck mixers.

Rubber Paving Tested

For some months a pavement of black and brown rubber has been under test at the entrance to a large plant, where traffic is very heavy, in Moscow, Russia. After nine months, during which time the pavement has carried thousands of trucks and wagons, and track-laying tractors have been run during the entire night, the experiment has been declared successful, according to a report from the U. S. Bureau of Foreign and Domestic Commerce. The pavement is noiseless, it is said that neither snow nor ice remains on it in winter, and it is easy to wash. The Moscow City Council is now negotiating for the laying of rubber pavements in one of the large sections of the city.

250 Bridges Need To Be Replaced in California

There are some 3,280 bridges in the state highway system in California, 250 of which should be replaced immediately, said George T. McCoy, Assistant State Highway Engineer, in a recent article in *California Highways and Public Works*. The costly upkeep of these old and in many cases unsafe highway bridges are creating a serious maintenance problem.

Approximately 1,000 of the bridges in the state highway system were not built in accordance with modern structural standards and have deteriorated to a point where constant inspections and repairs are necessary to afford safety to traffic. These should be replaced in the near future, in addition to the 250 which should be replaced immediately.

Many of the old bridges were inherited by the state when the Legislature added 800 miles of county roads to the state system in 1931 and an additional 6,800 miles in 1933. A greater number of these older bridges are on poor highway alignment, or the proper location of the highway itself requires that the bridge crossing be changed.

The estimated cost of replacement of the bridges requiring immediate attention is approximately $7,000,000, and of the replacements which should be made within the next 10 or 12 years, about $25,000,000. A major bridge construction program is the only solution to the problem.

New Belt Conveyor

A new light-weight versatile belt conveyor, which is designed to handle a variety of small material-handling jobs on construction projects, has been announced by the Atlas Conveyor Co., Clintonville, Wis.

This Model B-18, with a capacity of 30 to 70 tons of material an hour, is 20 feet long and is furnished with a Stover gasoline engine or with electric power. The 18-inch wide belt is covered with 4-ply rubber. Other features include electrically welded angles, all-steel head and foot pulleys, head pulley adjustment, with take-ups by 8-inch adjustable screws at the loading end. Drive is accomplished through chain and sprockets. The loading height is 12 inches and the discharging height, 8 feet 6 inches. The overall width is 5½ feet. The truck is of the rigid-axle type and the road wheels have a diameter and face of 36 x 4 inches.

Work of Clark County, Ks.

A large highway program for Clark County, Kansas, is out of the question because of the drought in that section of the country, C. E. Hommon, County Engineer, reports. However, the county has built one bridge this year in addition to its usual amount of grading and maintenance work. The county has a road unit system, every mile of which is under full-time maintenance.

The New County Highway Department Shop and Office Building Erected Last Year By Clark County, Kansas

The bridge is a four-span continuous girder structure 180 feet long, designed for a 10H loading, requiring seven 16-inch 45-pound WF I-beams for stringers. The floor is of 2 x 4-inch creosoted wood laminated with a compacted earth and sand wearing surface. The whole structure is of electric-welded construction. The stringers were welded where the dead load moment goes to zero and the splices are so arranged that there is a maximum of only four splices at any section of the bridge. The two end spans are 40 feet and the central spans 50 feet long. The bridge, which rests on creosoted piling 40 feet long, was built by the day labor method. The County Engineer reports that by the use of arc welding they saved enough on material cost to pay the major part of the cost of the new Lincoln electric welding unit which they recently purchased.

Last year the County erected a new shop and office building. This structure, 50 x 110 feet, built with the aid of WPA at a cost of approximately $12,000, contains the highway department offices, a drafting room, repair shop and main garage.

Laying Road Mix In City Streets

Recent WPMH Job in Nev. Combined Widening Road, Curb, Gutter, Walk

THE contract for the WPMH project completed last summer in Yerington, Nev., included widening the main street of the city for a distance of 4,400 feet on both sides of an 18-foot concrete pavement. The street is now 40 to 50 feet between curbs and new concrete curbs and gutters have been installed, a storm drain 18 to 12 inches in diameter installed and sidewalks 5 feet wide on both sides of the street outside the business district with a retaining strip at the back wherever the grade was raised.

Curb and Gutter Built First

The 18-inch concrete gutter was built integral with the curb which has a 7-inch base and a 6-inch top. The gutter is 6 inches thick and the curb rises 6 inches above the gutter. The curb and gutter were built in 25-foot sections with ½-inch expansion joints between and a dummy joint at the 12½-foot point.

Selected material from tested pits was placed under the curb and also 6 inches was first placed on the roadway section. This was pit-run aggregate of sand and gravel with a minimum shrinkage of 3 per cent on a 10-inch sample baked in a mold. On this was place 6 inches of crushed fravel from a maximum of 1-inch down to 200-mesh size. This material and the curbs were placed under a separate contract awarded to the Pacific Construction Co. of San Francisco, Calif.

Included in this contract also was the sidewalk on both sides of the street. The sidewalk is 5 feet wide and consists of ½-inch and smaller aggregate, later rolled. The sidewalks were shot with hot slow-cure cut-back at the rate of ½-gallon per square yard as a penetration and allowed to set and cure for a sufficient time to permit them to dry out. Then they were shot with asphalt emulsion at the rate of ⅛-gallon per square yard and screenings spread over the surface by hand, hand-broomed and rolled. The screenings were a maximum of ⅜-inch screen size.

Oil-Mix Day-Labor Project

The road-mix widening and shoulder paving was a day-labor project operated by the State Highway Department. The gravel that had been placed under the contract described above was shot with a slow cure road oil of 65 to 72 per cent asphalt heated to 200 to 250 degrees and cut back with a fluxing oil. For a finished road-mix of 2½ inches a total of 1.4 gallons of the road oil was applied in three applications of ½, ½, and 0.4-gallon per square yard. This allowed for the thickened edge at the curb and center concrete pavement where the oil mix is 4 inches thick.

The material with the oil was first harrowed with a spring-tooth harrow for the top 2½ inches and then bladed to the side in a single windrow with a motor grader and a pull grader. Then one-half the windrow was cut with the first blade and spread about 10 feet wide and the harrow run through to further the mixing. Usually a disc is used at the same time but on this job the discs were not used because they might have caused spalling of the concrete roadway and the newly laid concrete gutter. Equally good results were secured without the discs, much to the amazement of both Federal and State engineers.

The second blade then took the remaining half of the windrow and moved it to the far side of the 10-foot strip already spread. The first blade, on returning, spread this windrow for the remaining 10 feet to the concrete slab. This method permits the harrow being used constantly over the entire roadway and keeps the three machines, blades and harrow busy, thus completing the mixing in a minimum of time. The material is mixed by blades and harrow as many as eight times or even more for short stretches.

When the mixing was complete, the material was spread to uniform thickness except at the thickened edge. This edge was cut each time as the blades were run over the roadway. The road-mix was rolled at once with a 6 to 8-ton tandem roller.

After traffic had used the new road-mix for about 10 days it was sealed with a kerosene cut-back at the rate of ⅛-gallon per square yard. The use of the side strips for traffic greatly improves the character of the roadway section and gives a far better pavement when it is sealed. The kneading action of the traffic makes the top impervious and the seal material thus forms a water-tight membrane over the entire top. Without this action of traffic the surface is liable to be porous and the seal is likely to be absorbed and hence leave the top still slightly open and requiring another seal treatment at an earlier date.

C. & E. M. Photo

Concrete Curb and Gutter, Expansion Joint and Oil-Mix Roadway and Sidewalk

Personnel

The contract for the curb and gutter and the placing of the 6-inch course of pit-run gravel was awarded to the Pacific Construction Co. for $48,081.34. The road-mix was applied and the sidewalks completed by the maintenance forces of the State Highway Department under the direction of G. F. Armstrong, Division Maintenance Superintendent. Hubert Hall was Resident Engineer during the contract work. The oil-mix cost $4,000.

The New Koehring 251 Pull Shovel

A New Pull Shovel

One of the features of the new 251 pull shovel recently announced by the Koehring Co., 3026 W. Concordia Ave., Milwaukee, Wis., is the rigid welded box section jib frame which carries the boom connection well ahead of the turntable to assure solid ground footing for the multiplanes. The welded construction in the pull shovel attachment gives maximum strength and eliminates unnecessary weight at the digging end. Long and deep digging reach, high dumping lift and clean, easy dumping are additional features.

The reversible dipper teeth and renewable tooth bases are full manganese steel, attached to a special high carbon steel dipper lip. Side cutters are of high carbon steel. The booster drum mounted on the jib frame permits the use of one line to the dipper, eliminating the dragging of a bail block. The dipper width with standard side cutters is 36 inches, which can be increased to 42 inches by the use of wider side cutters. The dipper is made of special abrasion-resisting steel.

Complete details of this 251 pull shovel, which has the general features of the 251 excavator announced not long ago, are contained in a new bulletin which may be secured direct from the manufacturer.

Grout Mixer and Ejector

While the Union grout mixer and ejector, made by Union Iron Works, Inc., Elizabeth, N. J., is designed for use in tunnel work, it is also applicable for such jobs as stopping and sealing leaks in dam footings, canals, and sewers; strengthening and preventing settlement of footings and foundations; raising pavements; rebonding masonry bridge piles and similar work.

The Union grout mixer is a positive-mix machine, having a shaft with a series of paddles rotating within the mixing and ejecting drum. Any semi-fluid mixture can be handled and stone or gravel passing a ½-inch square mesh screen can be used in the machine. The mixing and ejecting drum is charged through an air-lock-type door which seats against a gasket and holds air tight as long as ejecting air is turned on, and opens when pressure is off. The standard units are equipped with air engine drives, but electric motors or gasoline engines can be furnished if desired. A compressor delivering 125 cubic feet of air at 90 to 100 pounds pressure is ample for all average work with a 7-cubic foot machine and 150 cubic feet is ample for the 10-cubic foot machine, both based on air-engine drive.

These grout mixers and ejectors, eight of which of 10-cubic foot capacity were used for the Fort Peck tunnels, as well as other equipment for tunnel and heavy construction, are described in Bulletin No. 163 which may be secured direct from the manufacturer by mentioning this magazine.

New Catalog on Drill Steels

A new 44-page catalog entitled "SKF Drill Steel" has just been issued by SKF Steels, Inc., 369 Lexington Ave., New York City. This new booklet is designed for practical use, containing considerable data gathered from various sources on the purchase and use of drill steel for rock drills, as well as describing in detail the features of SKF drill steel.

Copies of this interesting and well-illustrated catalog may be secured direct from the manufacturer by mentioning this magazine.

Unusual Underpass Project in Chicago

(Continued from page 11)

No "Slow" orders can be issued so the work is being carried on in five stages. As part of the work is completed, the tracks are transferred to the new section. Because of the high speed of the trains, an operating plan and schedule was set up so that no man would have to cross the railroad tracks at any time.

To place the concrete in the abutments and piers, the concrete mixing plant was set up on a high bank and the concrete discharged from the Koehring 27-E paver into the hopper of the Rex Pumpcrete at a lower elevation. The concrete was then pumped through a 7-inch pipe directly into the caissons, abutments, piers and the poured-in-place sections of the floor slabs. The greatest distance the concrete has to be piped is 425 feet.

No. 6 concrete, made up of 1,960 pounds of gravel, 1,385 pounds of sand, six bags of cement and 25 gallons of water per cubic-yard batch, was used throughout for both underpass and the grade separation structure at the Outer Drive. The maximum slump for the caissons was 2 to 3 inches; for the heavy sections, 3 to 4 inches; the light walls and columns, 5 to 6 inches; and the structural steel encasement, 6 to 7 inches.

About one-third of the deck slabs were poured in place, and the remainder in precast slabs, the largest being 26 feet long, 6 feet 5¾ inches wide, 2 feet 11 inches thick and weighing 37 tons. These slabs, which are heavily reinforced, were poured and allowed to cure to the required strength before they were needed in the work, in order to minimize the time between stages.

Intercepting Sewer

One of the features of this project was the construction of an intercepting sewer. Because of the construction of the underpass beneath the railroad tracks, it was necessary to abandon an 8-foot sewer and construct a new one at Elev. -14 to take the flow from the old one west of the tracks into the main sewer east of the tracks.

The ground water in the area of this work is about 3 feet above Chicago city datum, making it necessary to do the tunnel work under air pressure. A shaft of Lackawanna AP14 steel sheeting, 28 feet long, was driven at the west side by the Bucyrus-Erie 42-B crane using a 9B2 McKiernan-Terry and 1800 Vulcan hammer. This sheeting was driven so that the bottom of the steel penetrated about 3 to 4 feet into the clay, thus sealing off the water.

During the driving of the tunnel under air pressure, there was no settlement of the temporary trestle under the railroad despite the fact that in some instances the piles of the trestle would not go below the elevation of the tunnel work. The tunnel, which is 6 feet 4 inches high and 5 feet 8⅜ inches wide, was driven from the shaft on the west side of the railroad to about 18 feet from the main sewer on the east side of the track with which the tunnel was to connect. The tunnel was driven under 4 pounds air pressure. An Archer Iron Works air lock was used. Pressure for the tunnel and for operating the air tools was supplied by a battery of five gas-driven air compressors, three 210-cubic foot, one 260-cubic foot and one 160-cubic foot actual displacement. The same equipment used for caisson excavation was used for excavating the tunnel.

Excavated material was loaded into steel cars of 16-cubic foot capacity which were pushed out by hand through the air lock to the shaft and from there hoisted by a Buckeye crane and dumped to a pile, from which the material was later removed by truck. During the construction of the tunnel, work was carried on in three shifts, two digging and one concreting. While the concreting was going on, the crane used to handle the excavated material was used to load the material from the pile to the trucks which took it to the dump for disposal. The concrete in the tunnel was 10 inches at the top and 15 inches at the invert. It was vibrated with a Thor clay digger using a special vibrator tool.

The tunnel shaft, about 13 x 24 feet and 26 feet deep and of temporary construction, was made entirely of steel, including the winding Simpson Frisch stairway which was also entirely enclosed in steel. The ground level at the shaft was approximately +12 and the bottom of the shaft was -14 except for the sump, which was about 5 feet lower. A Yeomans electric pump was used in the shaft during the entire construction. The total length of the sewer was about 290 feet, including the end connections, about 190 feet of which was built as a tunnel under air pressure, the balance being constructed in open cut.

To make the connection between the new tunnel and the main sewer, a timber bulkhead, considerably larger than the connection, was built inside the main 15-foot sewer and made water-tight. After the bulkhead was placed and sealed, the wall of the main sewer was cut out and a water-tight connection made from the new sewer into the old one, doing all the work in the dry.

At the west end of the project, the sewer under construction runs beneath the old sewer. A connection between the two was made, the flow taken from the old to the new sewer and the old one abandoned. This was done by excavating with the Bucyrus-Erie and Buckeye cranes to about halfway down the old sewer, removing the top sec-

(Continued on page 37)

Hydraulic Lifting Jack Has Independent Pump

The Dudgeon universal hydraulic jack, made by Richard Dudgeon, Inc., Columbia and Broome Sts., New York City, has an independent pump, connected with the cylinder by means of a flexible copper pipe 12 feet long. The cylinders and rams are of standard length and are capable of lifting a live load the full run-out of the jack.

The pump contains a double unit, so that when the load is light, the double pump will raise it with twice the speed of the single pump. When the load is heavy, a quarter turn of the valve handle will throw out one pump, giving the action of a single-pump jack. The jack can be lowered by either the lever or the valve handle, and as the valves can be operated independently of the pumping mechanism, they may be opened and cleared of any obstruction preventing their proper seating by working the pump.

These jacks, which vary in lifting capacities of from 40 to 150 tons, are described in literature containing full specifications which may be secured direct from the manufacturer by mentioning this magazine.

Single-Stage Compressor Has Many Improvements

An improved single-stage horizontal air compressor for heavy-duty full-load service and continuous operation at low power costs has recently been announced by the Gardner-Denver Co., Quincy, Ill. This RX compressor has a totally enclosed dust-proof construction, without sacrifice of accessibility, as well as accurate balance and freedom from vibration, according to the manufacturer.

One of the features of this compressor is the electro-pneumatic control, by means of which the compressor always starts unloaded and the air supply is automatically adjusted to fit the air requirements. These compressors are equipped with Timken tapered adjustable roller main bearings.

Conchas Dam, N. M., To Control Floods

Structure on South Canadian River To Be Completed in 1939, Part of Federal Flood Control Program

THE construction of the Conchas Dam on the South Canadian River in New Mexico will materially reduce flood damage in the valley of that river in the States of Texas and Oklahoma by impounding and retarding the flood waters. In addition to the flood control benefits, preliminary reconnaissance indicates that approximately 50,000 acres of New Mexico land may be irrigated. The dam will be located approximately one-quarter mile below the confluence of the South Canadian River with the Conchas River in San Miguel County.

The project was approved by the President on July 29, 1935 as a part of the Works Relief Program under the Emergency Relief Appropriation Act of 1935 and was adopted by Congress in the Flood Control Act of 1936. Its purpose is to provide, in addition to flood control and irrigation, municipal water supplies, although the construction of distribution works are not included in the present project.

Description of Project

Conchas Dam will consist of a concrete gravity main dam approximately 235 feet high and 1,250 feet long, located in the canyon of the South Canadian River, and earth dikes on each side, extending the overall length to about 4 miles. The main dam will contain outlet conduits located in its base, capable of releasing water to maintain low water flow, as well as permitting drainage of the reservoir. The main dam will contain about 670,000 cubic yards of concrete and the earth dikes will require approximately 3,600,000 cubic yards of fill material. An overflow spillway 300 feet in length will be constructed in the main dam and in addition an emergency spillway 3,000 feet in length will be provided between the north dikes to take care of large floods.

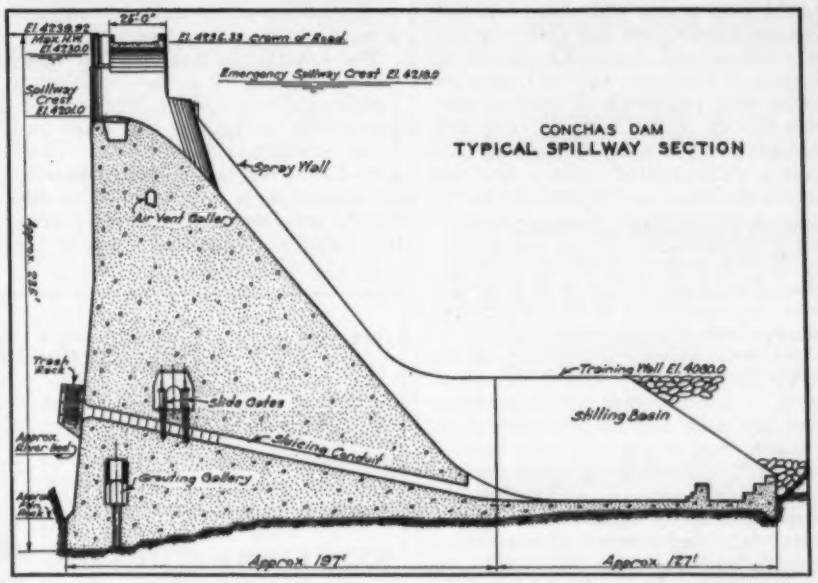
The reservoir created by the completed dam will have a storage capacity of approximately 600,000 acre-feet and an area of about 26 square miles. It will extend up the South Canadian River valley about 14 miles and up the Conchas River valley about 9 miles.

Progress of Work

In order to employ a maximum of local labor in the construction operations, buildings in the construction camp were made largely of native materials.

To expedite construction of the project and to develop advance information on foundation conditions, the Government commenced excavation operations for the main dam by hired labor in December 1935 and continued these operations until October 1936 when they were taken over by the contractor.

Plans and specifications for the construction of the main dam and contiguous wing dams were advertised on August 1, 1936 and the contract for this work was awarded to the low bidder, Bent Brothers, Inc., and Griffith Co. of Los Angeles, Calif., on their bid of $4,587,676.25, the bid not including the cement which is being furnished by the Government under separate contract. The contractor started work on October 15, 1936 and the contract is scheduled for completion during the spring of 1939. Other features of the work will be covered by subsequent contracts or will be constructed directly by the Government by hired labor. The entire project, scheduled for completion June 30, 1939, will cost approximately $12,500,000.



County in Tenn. Builds Tar and Cotton Roads

(Continued from page 1)

laid soon with WPA labor and cotton fabric furnished by the U. S. Bureau of Public Roads, Department of Agriculture, which has advocated such roads as a new outlet for cotton.

Shelby County, lying along the east shore of the Mississippi River and with Memphis as the county seat, has an area of 750 square miles and a county road mileage of 1,400 miles, exclusive of state highways. The maintenance and improvement of these roads is the real problem of the County Commission, according to Road Commissioner L. F. Jones. When the Commission started out in 1912 to improve the roads the traffic was light and merely surfacing the roads with gravel brought commendation.

The graveling of the main roads gradually spread throughout the county, bringing with it a continual increase of traffic. As the traffic increased it was evident that a better type of surface was needed to withstand the wear.

Bituminous Surfacing

The next step in the improvement of the county roads was surfacing the most heavily traveled roads with a bituminous binder to hold the gravel in place and prevent obnoxious, expensive and dangerous dust. This program was greeted with such a clamor of applause that "It was a case of oiling or lynching . . ." according to Mr. Jones in our interview. As this work progressed a number of the roads adjacent to the city were given penetration treatments about 4 inches thick on account of the heavy type of travel. However, in most cases, a double surface treatment or a mixed-in-place job has been found sufficient.

This program is increasing each year so that at present more than two-thirds of the road mileage has a bituminous surface. The bituminous materials used have included asphalt, rock asphalt, cut-back asphalt, asphalt emulsion and tars. The double carpet treatment consists of giving the gravel a shot of one-half gallon per square yard, covering this with binder gravel and rolling, then giving a second shot of 0.3 gallon per square yard and covering with pea gravel and sand.

For road-mix surfacing, the material in the road is shot with about 0.75 gallon per square yard and pulled up into a windrow and thoroughly mixed by cutting it first one way and then the other with motor patrol graders until dry enough to be "tacky." It is then spread into place by the graders and rolled. The treated surface thus obtained is from 1 to 1½-inch thick.

Equipment and Labor

The bituminous materials are purchased in car lots and unloaded directly into the distributors or into a concrete storage tank with six compartments located at the County Oil Station on the Union Belt Railway where the equipment is concentrated. This concrete tank, 40 x 60 feet in plan and about 10 feet deep, is equipped with heating coils for handling the heavier materials.

The county owns two distributors, six motor patrols, a 60-ton tractor and heavy-duty grader with a 12-foot blade; a fleet of eighteen dump-body trucks for hauling; four 12-ton rollers with scarifiers attached; two motor-powered mowers for cutting weeds and grass on sides of road and three draglines.

The county employs its own labor which is augmented by convict labor, a variable quantity and quality,—depending on the sessions of the court and crime production in general. There have been very few WPA projects in the county as it is impossible to mix convict and free labor, except by using free labor to direct the work of the convicts.

The Shelby County budget for 1936 for roads and bridges amounted to $333,500 for road construction and maintenance and $62,700 for bridge maintenance. The figures vary considerably from year to year as they are proportional to the total tax collected on a mileage basis.

H. V. Patton is County Engineer of Shelby County, Memphis, Tennessee.

Avoid Legal Pitfalls

These brief abstracts of court decisions may aid you. Local ordinances or state laws may alter conditions in your community. If in doubt consult your own attorney.

Edited by A. L. H. STREET, Attorney-at-Law.

Subcontractor's Fault; Contractor Exonerated

"When your subs on that highway construction job blew out the old culvert near my place, they used more dynamite than was necessary," complained a Kentuckian to a general contractor. "As a result, $2,000 damage was done to my house through cracking of walls, loosening of doors, etc. So, please let me have check for $2,000."

"This is too far from Christmas for me to pretend I am Santa Claus," the contractor may have replied. In any event, he disclaimed liability for the fault of the subs in using too much explosive.

"The subs were doing work that the general contractor had undertaken to do and he is liable for their fault" is what the complaining householder's attorney probably assured him, because suit was brought against the general contractor. But the Kentucky Court of Appeals was more impressed by the argument of the attorneys on the other side of the fence, for that tribunal exonerated the "general." (Harris v. Stone, 77 S. W. 2d, 18.)

The court intimated that if the nature of the work had been such that damage to adjacent property was a natural consequence of doing the work in a proper manner, and the job had been done properly, the general contractor might have been held liable. But it was decided that the subs were independent contractors and that their use of more dynamite than was necessary was not a fault that could be laid on the general contractor's doorstep.

Superintendent as "Laborer"

If a construction superintendent wears out shoe leather walking around a job, he may be regarded as a "laborer" within the protecting provisions of the contractor's bond for payment of labor claims. But if he sits at a desk in the contractor's office and discharges general managerial duties for the contractor, the law will not let him recover on the bond for unpaid compensation, even though he is willing to so far abase his work as to call it "labor." And if he be paid lump sum compensation for both kinds of work, the law will not attempt to apportion part of his pay to services on the job, and allow him to recover to that extent on the bond. That, in a nutshell, is what the Massachusetts Supreme Judicial Court said in the case of Look v. City of Springfield, 198 N. E. 661. Said the court in part.

"The statute cited, so far as it applies to this case, gives a remedy only to obtain 'payment * * * for labor performed' in the 'construction' of the water works. It is true that the word 'labor' does not connote a laborer in the ordinary sense, but includes the work of a skilled superintendent. * * * We think that part of the work done by the plaintiff, in engineering and in acting as the managing business executive of the contractor with reference to this job, was not within the statute. * * * Since all his work was done under an entire contract for an entire salary, no apportionment can tbe made in the absence of statute so as to afford him the statutory remedy for the superintendence alone."

Sewer Contractor Wins Suit

The trustee in bankruptcy of a construction company had to jump several legal hurdles before he fastened liability on a city in New Jersey for an amount payable under a sewer construction contract. But he cleared them all. (Inhabitants of City of Plainfield v. Palmer, 72 Fed. 2d, 312.)

"In the first place," insisted the city, "the contractor did not become entitled to payment because no engineer's estimate was produced." "But," replied the United States Circuit Court of Appeals, Third Circuit, "you refused to pay him before he had a chance to ask the engineer for an estimate. That made a demand upon the engineer for an estimate futile. Moreover, although the contract provided for obtaining an estimate, it did not make an estimate a prerequisite to recovery by the contractor."

"Well, then, in the second place," contended the city, "we never formally accepted the sewer as constructed according to contract." "But," answered the court, "you took over the sewer and used it, and that was an acceptance. 'Actions speak louder than words.'"

On other objections by the city, the court ruled that if the contract was substantially performed by the contracting company, although not in strict compliance, the contract price, less a fair amount to cover the cost of remedying defects, was recoverable; and that interest was properly awarded the plaintiff on the amount due, computed from the date the work was completed.

Building Highway Tunnels in Canyon

(Continued from page 6)

all times, using air from the high-pressure lines bled through a ¼-inch hole to an injector which carried a large volume of air forward to the face through two 4-inch lines laid on either side of the tunnel floor and carried up to the face. The regular air line pipe was used for this purpose.

Mucking the Tunnels

There were two drillers for each of the drifters in the tunnels so that they could change off and give every man an opportunity to work at the major operation. This is a part of the work system; no man is allowed to hold any one job during his work in the camps but must move around to have a chance at all jobs. Thus favoritism is prevented and the idea of superiority of any one man or the formation of cliques is prevented. The powder man and his helper were among the 25 per cent free labor in the camp.

The tunnel headings were hand mucked throughout, using eight men on each of the two shifts. They loaded to a Koppel industrial car with a 1-yard end-dump body. The material was wasted from the nearest adit except where needed for the approach fills at the ends of the tunnels when they started from deep ravines. At the adits the material was finally disposed of by pushing over the bank with a tractor on which a bull-dozer was mounted.

The mucking of the tunnel enlargement was done with Caterpillar Sixty and Seventy-Five tractors, using an Ateco 3-yard and 4-yard and a Knapp-LaPlant-Choate 6-yard scraper. This is perhaps the first record of a tunnel being mucked by tractors and scrapers. The machine that handled the disposal of the muck at the adits was a Caterpillar Thirty-Five with a bulldozer. It also hauled a 3-yard McMillan scraper when there was a considerable amount of rock to be brought to the adit.

The quantities of rock actually removed from the three tunnels were: No. 1, 6,265 cubic yards; No. 2, 9,521 cubic yards; and the final quantity for No. 3 was about 31,250 cubic yards. The estimated costs were $4.50 per yard and the actual costs were about $4.00. It is interesting to note the detail with which the records were kept in the camp for all costs, whether construction or maintenance and commissary. This is essential as all the costs are charged to the operation of the job. The jackhammers produced on an average 90 feet of hole in 8 hours and in the open cut sections an average of ¾-pound of explosive was used for each cubic yard of rock removed.

Housing

The housing for the men was provided in a camp of buildings built of 10 and 12-foot panels lined with Sisalkraft paper and with corrugated iron roofs. As the sun is intense and there is plenty of water the roofs had ¾-inch pipes run along the ridge poles and perforated so that the roofs could be sprinkled and the houses cooled.

Personnel

The work described was done by a camp of about 180 men from the San Quentin prison with the assistance of about 50 free men working on power equipment. This camp No. 30 was in charge of Ed. Rawson as Superintendent. The representative of the California Division of Highways in charge of the engineering phases of the work was George M. Webb, Resident Engineer. Another camp, No. 28, of 80 convicts and 20 free men, operated from the easterly end of Route 21, constructing a highway toward the tunnels to complete the route by August, 1937. Camp 28 was combined with Camp 30 in November, 1936.

These camps are not fenced, there being only camp limits beyond which the convicts are not permitted to go without the permission of the guards and then only for performing work. The camp guards, who are not armed, are responsible to the Warden of San Quentin. The general supervision of construction and engineering features, including the camp commissary, was in charge of M. S. Pope, Construction Engineer, California Division of Highways at Sacramento, while all details of construction were carried on under the direction of F. W. Haselwood, District Engineer for the Division of Highways at Reading.

New Bulletin on Material Handling Plant Accessories

Iowa Mfg. Co., Cedar Rapids, Iowa, has recently published a new Plant Accessory Bulletin No. X-1 covering the details and specifications of items generally termed as accessories to larger portable material-producing plants.

This bulletin contains detailed information on Cedar Rapids-Symons horizontal vibrating screens, revolving screens, steel trucks, bucket elevators, conveyors of the lattice and channel frame type, portable stock piling and field conveyors, rock and gravel feeders, steel bins, Iowa Rokarts, drag scraper buckets and accessories, special hoppers and grizzlies, drag scraper sand tanks and V-Belt drives.

Copies of this Bulletin No. X-1 may be secured direct from the manufacturer by mentioning this magazine.

Caterpillar Plant Addition

Additions amounting to half a million dollars are nearing completion at the Peoria, Ill., plant of the Caterpillar Tractor Co. These include a 101 x 900-foot addition to the machine shops, a new two-story building for the engineering, tool design and apprentice departments, and a $200,000 addition to the road machinery building which will have 190,000 square feet of floor space for the storage of diesel-powered track-type tractors and road equipment.

Good Organization and Equipment Defeat Snow

(Continued from page 2)

skeleton crews reside in the vicinity of the storage yard and can be reached by telephone. There are usually three men per crew for the power unit and such extra labor as may be required to widen the snow cuts. Service men familiar with the equipment complete the organization and these men are on duty as long as the equipment is in service.

The primary system is the first opened and then the secondary and streets in the rural additions. At no time has the primary system been closed for more than two hours and the secondary ten hours.

Equipment

The equipment used consists of three large Ross snow plows on 2½-ton trucks, one county-built V-plow with 80-hp Cletrac, one La Plant-Choate with 60-hp Caterpillar, one Snow King rotary direct-connected on a 60-hp Best, one small Ross on a 2½-ton truck, two 30-inch blades on 2½-ton trucks, four Caterpillar diesel maintainers with V-plows, one Adams diesel-powered wheel maintainer and two Sargent V-plows on 5-ton FWD trucks.

The methods and equipment used have been entirely satisfactory, and the addition of the two Sargent V-plows and two 5-ton FWD trucks during the year of 1936 makes the snow removal equipment of Douglas County all that could be desired.

A New Feature for Electric Hammer Drill

A new type of tool retainer has been developed by the Wodack Electric Tool Corp., 4627 W. Huron St., Chicago, Ill., and is now standard equipment on all Wodack electric hammers, including the Do-All combination electric hammer and drill.

This retainer is made entirely of moulded rubber, fits over the nose of the hammer, and holds the cutting tool in place with just the right amount of play for rapid drilling or cutting, but prevents any possibility of the drill or hammer dropping out. It also keeps grit from getting into the socket in overhead drilling. Complete information may be secured from the manufacturer.

Unusual Underpass Project in Chicago

(Continued from page 31)

tions and placing a steel sewer of smaller diameter within the old one. The old sewer was then sealed with concrete bulkheads and the flow carried by the temporary steel sewer. The size of the temporary sewer, less than the old one, was determined by a study of the flows at all hours of the day and during rainy periods and was large enough to take care of maximum requirements.

When the temporary steel sewer was installed and carrying the flow, all of the brick work in the old sewer was removed and the entire area excavated to the depth required by the construction of the new sewer. Part of the excavation was loaded onto a dump truck and taken to the disposal area and the balance was cast onto a pile to be used later as backfill. When the new sewer was constructed, a riser was put in from the new sewer to the temporary steel sewer and concrete poured up to the shell. When the concrete riser had set, a section of the steel sewer was burned out and the flow taken into the new sewer.

Outer Drive Grade Separation

Another phase of the project was the construction of the grade separation bridge on a pile foundation at the Outer Drive. Where the cut-off of the piles was below datum, wood piles were used; where the cut-off was about datum, Union Metal Mfg. Co. corrugated steel shells, 60 feet long, with an 8-inch tip and 16-inch butt, reinforced and filled with concrete, were used. These shells were driven to refusal by the Bucyrus-Erie steam crane with 75-foot leads and the 9B2 McKiernan-Terry hammer. The shells stood up very well during driving.

Good Progress Made

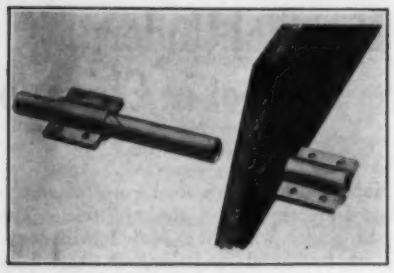
The contract for this work calls for the completion of the highway underpass and grade separation bridge before the end of the year. Despite the necessity of maintaining uninterrupted railroad traffic at all times, the work to date has progressed satisfactorily. The sewer built under air pressure underneath the tracks has been completed without any settlement of the temporary railroad trestle; connections have been completed and the flow of the sewer diverted; all caissons to the east of the present right-of-way have been put down to rock and concreted without any mishaps. This has been due in great part to the safety measures taken and the methods of construction used. The shutting off of the water in the shaft by driving steel sheeting into the clay and in the caissons by the use of the steel shells proved to be money well spent.

The small air pumps proved very successful in handling what little water was encountered, since they are very flexible and can be moved by one man.

Personnel

This $500,000 project is being constructed by N. S. Mackie Co., Chicago, Ill., for the Chicago Park District. The structure was designed by and is being built under the supervision of the Chicago Park District: Ralph H. Burke, Chief Engineer; Robert A. Black, Assistant Chief Engineer; C. T. Kelly, Assistant Structural Engineer; M. P. Black, Assistant Engineer and Resident Engineer in charge of the work in the field. George E. Tamm is General Superintendent in charge for the contractor.

The U.S.E.D. flood-control program in Louisiana and the work in the Atchafalaya Basin will be described in a series of articles starting in our November issue.



Method of Inserting a T-G Bar in a Standard Joint

A New Dowel Device For Concrete Joints

A new device designed to provide a dependable connecting support at the joint between concrete slabs, to eliminate vibration during load transfer, and at the same time to permit free lateral slab movement during temperature changes, has been announced by the Five-Way Expansion Joint Co., 20 No. Wacker Drive, Chicago, Ill.

This new T-G Bar consists of a pair of stress reducers and a metal sleeve of special analysis steel stampings, a dowel and two caps for closing the ends of the sleeves to seal in a lubricant. The smooth cold-rolled dowel fits tightly within the sleeve which, when lubricated, forms a metal bearing, permitting it to float freely during expansion and contraction. The stress reducers each consist of two pieces, held together by four rivets, two in each of the bond wings. When in place, these wings lie in the horizontal plane of the slab and provide in the concrete an additional bearing surface of approximately 11½ square inches and eliminate practically all dowel stress.

The T-G Bar is completely assembled at the factory and comes to the job in two parts. A hammer to drive them together is the only tool necessary.

To install the T-G Bar at the expansion joint one end is slipped through the hole of the cushion material. With the bar in place, the stress reducer for the opposite side is driven over the sleeve until it comes flush with the joint. The helical slots at the centers of the sleeves are then entirely within the joint, whether it be air cushion type or of solid material. When the second stress reducer has been driven home, the workman has nothing more to do but see that the wings are in the horizontal plane.

It is claimed that the T-G Bar will not wedge and no indication of funnelling has yet been found where it was installed. They are set on 20-inch centers, using only 12 for each 20-foot joint. This Bar has been approved by the U. S. Bureau of Public Roads and is now included in many state standards.

New Line of Protective Clothing for Welders

A new line of protective clothing for welders, for acetylene or electric arc work, has been added to the line of safety equipment made by the Davis Emergency Equipment Co., Inc., 55 Van Dam St., New York City. The Davis line of protective clothing for acetylene welding includes goggles, sleeves, aprons, leggings, spats, and gloves, and for electric welding includes helmets, hand shields, sleeves, aprons, coats, pants, leggings, spats and gloves.

The goggles, helmets and hand shields are equipped with glasses of various shades, each suitable for a special type of work. There are five different shades of goggles, ranging in use from light brazing to heavy welding, and three different shades of glasses for helmets and hand shields, for light and heavy metallic electrode work and for carbon arc work.

This protective clothing is made of three materials, fireproof duck, asbestos, and chrome leather, although the latter is especially recommended because it remains soft under heat and is more durable. All Davis garments are designed to give the worker maximum ease while working. The garments for use in arc welding protect the body from the effects of ultra-violet light as well as from heat and sparks.

Complete information on the Davis line of protective clothing, as well as other Davis safety equipment, may be secured by interested contractors and engineers direct from the manufacturer by mentioning this magazine.

$200,000 Program of Weed, Brush Cutting in Minnesota

The Minnesota Highway Department has expended approximately $85,000 and will be required to expend at least $200,000 before the close of the season for the mowing of roadsides and the eradication of noxious weeds on the state's 11,350-mile system. The department's activities in this field, although costly at the outset, will serve a triple purpose and ultimately prove to be a definite economy, according to Commissioner Elsberg.

First, the cutting of noxious weeds eliminates what otherwise would be an ever-present menace of re-seeding adjoining farms with weed pests. In the second place, the cost of fall mowing and brushing which is now under way is many times repaid by winter savings in snow removal. Weeds and brush cause roadways to fill up with snow, and their elimination reduces plowing expense. Thirdly, mowing and brushing are essential not only for improvement in the appearance of roadsides, but to assure clear visibility on curves and turns and ready legibility of traffic warning and directional signs.

Inspection of Wire Rope

Wire rope should be inspected at frequent regular intervals by qualified persons and a written record should be kept of each inspection. Any defects should be corrected without delay. Each inspection should cover the following points:

1. Is rope of the proper size, construction and material for the purpose used?
2. Are there evidences of corrosion, wear or kinks?
3. Are the fastenings tight and applied in the proper manner?
4. Are there any broken wires on the outside or crown of the rope strands?
5. Is the rope properly lubricated? Upon evidence of lack of proper lubrication, ascertain the internal condition of the rope.
6. Make sure that sheaves and drums are of the proper size and design, that grooves are not rough, scored or worn so as to damage the rope, that bearings are not worn so as to cause the sheave or drum to wabble or run out of alignment.
7. Look for evidences of improper use of rope by overloading, reverse bends, etc.
8. What is the condition of splices, if rope is spliced?

Other important points in the selection, use and maintenance of wire rope are contained in the Safe Practices Pamphlet No. 26 on wire rope, published by the National Safety Council, Inc., 20 No. Wacker Drive, Chicago, Ill., copies of which are available at 25 cents each.

New Line of Snow Plows For Light Motor Trucks

A new improved line of snow plows built to match the power output of 1, 2 and 3-ton trucks has been announced by The Austin-Western Road Machinery Co., 1815 Barrows St., Aurora, Ill. The manufacturer has carefully designed and fabricated these plows to obtain improved balance and greater strength and the moldboards are curved to handle a maximum quantity of snow with a minimum expenditure of power. All excess weight has been avoided as an aid to truck operation and to permit quick and easy attaching and detaching.

The line comprises nine models of which there are three general types: the V-type, the taper-blade type and the straight-blade type. The various types, of a given size, are interchangeable on the same underframe.

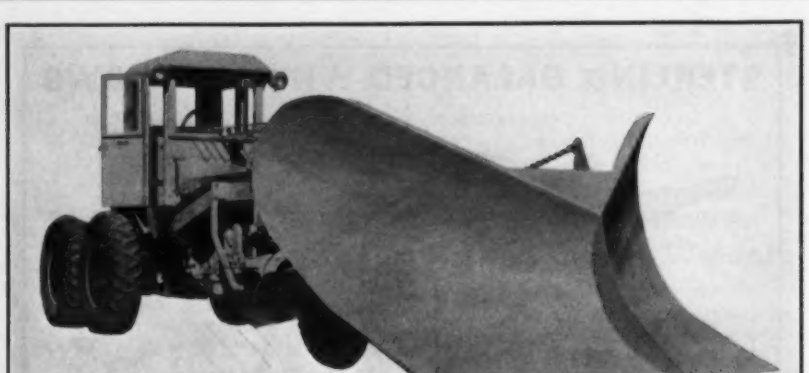
Austin-Western's Three New Snow Plows

The plows are built with rubber-tired caster wheels, cast iron runners, safety spring releases and means to adjust the pitch and plowing angle of the blades. New bulletins describing these plows have been issued and may be secured direct from Austin-Western.

New Express Highway and Dike for Hartford, Conn.

A dike to protect the City of Hartford, Conn., against floods in the Connecticut River, which would be topped by a four-lane boulevard 7 miles long and traversing the entire length of the city from north to south, has been proposed by the city engineering department and is now being studied by the flood commission, according to a report in a recent issue of *The Nerba*.

The plan calls for widening a number of principal business streets, building of ramps, and construction of a new clover-leaf approach to the East Hartford Bridge.



The Galion V-Type Snow Plow Available for Mounting on Galion Gas or Diesel-Powered Heavy-Duty Graders

Graders with Snow Plows For Year-Round Road Work

The Galion heavy-duty motor grader with Case LI power and hydraulic control and the Galion Master diesel motor grader, made by the Galion Iron Works & Mfg. Co., Galion, Ohio, are both designed for all types of heavy-duty road maintenance requirements. Both of these graders may be equipped with the V-type snow plow illustrated, electric lights and fully-enclosed cab, converting them into snow fighting units.

Hydraulic control is standard on both machines. Only a slight pressure backward or forward on the short range levers located directly in front of the operator makes every adjustment of the moldboard. Power for one of these models is furnished by a Case Model LI engine developing 57 hp and for the diesel grader by an International Model TD-40 4-cylinder diesel.

Complete information on both of these grader models and on the V-type snow plow which is available for use with them is contained in literature which may be secured from the manufacturer.

Increased Activity at Diesel Engine Plant

The increased activity and production of two new models at the plant of the Murphy Diesel Co., Ltd., Milwaukee, Wis., has necessitated an increase in the force in all the company's departments, as well as an addition to the executive officers of the company. R. A. McClevey, formerly Secretary of the Northern Illinois Coal Trade Association, has been made Vice President and General Manager.

The company has recently brought out a new diesel engine, manufactured in two sizes, a 4-cylinder model for uses requiring up to 100 hp and a 6-cylinder model for uses requiring up to 150 hp continuously. Features of this new engine are its simplicity of design, ease of starting, and a simplified solid injection fuel system.

A single control wheel acts as a throttle as well as operating the simple gasoline starting mechanism, enabling the change to be made from gasoline operation to diesel oil at will. The governor, actuated by oil pressure, acts as an automatic cut-off for low lubricating oil supply, stopping the engine immediately if the oil pressure fails, and a heat exchanger between the cooling water and lubricating oil serves to give quick warm-up to the lubricant in cold weather and to prevent over-heated oil in hot weather.

Each cylinder of this engine is provided with a complete independent injection unit mounted on the cylinder center, and driven directly from the overhead camshafts. Filtered fuel is supplied at low pressure to within 1 inch of the nozzle tip, the fuel injector metering the fuel and injecting it through a passage about 1 inch in length. Each fuel injector is a complete independent and interchangeable unit and can be quickly removed by loosening one special nut. Provision is made for checking the operation of these injectors while the engine is running, simplifying the locating of any trouble.

Information on these new engines may be secured from the manufacturer.

Road Stabilization Through Drainage

It's the Water That Gets Down Under That Does the Damage and Which Must Be Removed for Stability

By C. W. McCLAIN, Former Engineer of Maintenance, State Highway Commission of Indiana

SEVERAL years ago I had some experience designing and supervising the construction of quite a mileage of county roads. By authority of the Board of County Commissioners, we installed two lines of 4-inch tile at each edge of the traveled way and parallel to the center line. Taking a hint from farm tile drainage in the adjacent fields, it was thought that many difficulties from troublesome underground water would be solved by this method.

If tiling placed 30 inches deep and 4 rods apart in a field would make it more tillable and allow earlier plowing, surely two lines of tile some 24 feet apart would make a solid road. The tile was installed but, much to the consternation of all those interested, they did not seem to do any appreciable good. When spring came, the roads broke up just the same.

What was overlooked was that draining a field for agricultural purposes and draining a road to make it stable enough to carry traffic are two entirely different problems. The farmer is not alarmed if his field goes soft for a few days, which it does, though he does not want that condition to prevail very long. However, between the time the field gets soft and it becomes settled, the soil is undisturbed and is not called upon to support any load. The soil carrying road material and its superimposed load has to function in an entirely different way. The best way to keep a road from failing because of softness is to prevent its getting soft.

How Does Water Get There?

There are two ways undesirable water gets into the subbase; one is through the surface and the other from underneath. Free surface water is easily seen and its actions followed. Methods of correction are obvious. Free water adjacent to the road seems to make little difference. Experience with water-free side ditches and those filled with water indicates there is little difficulty from free surface water.

Water action underneath the surface is much more difficult to ascertain. It was not known until recently that impounded water under the surface was causing a great majority of such break-up troubles. After proper investigation and recommended correction, the trouble caused by impounded water almost entirely disappears.

In the Indiana state highway system, we have had good pavements break through and vehicles mire down for no reason apparent from the surface. Almost invariably, when a subsoil survey was made, we found pocketed water which, together with poor soil conditions, caused the trouble. It seems strange that road builders should have gone along for so many years, paying so little attention to the soil, the one thing of which we have most. The waste of road money due to lack of understanding of soils would have endowed a soils department in every engineering school in the country. It remained for a few pioneers who by persisting year after year have made our road engineers soil-minded.

Soil Stabilization

When we did wake up, many schemes came into use for soil stabilization. The search for cheaper stable roads became diligent, for the need had long existed and it had been found that the solution rested with the soil.

New terms and nomenclature have sprung up. Methods of determining mixes, collodial chemistry, base exchange, film thickness, plasticity index, internal friction, optimum moisture content, soil fines, and so on have moved before our wondering minds in kaleidoscopic rapidity and confusion. It behooves us to think clearly through these, analyze our problems and not be stampeded into putting too much expenditure into these new fields too soon. But we must keep on experimenting. The possibilities are unlimited and are a challenge to road engineering minds. It has opened up a great new field and road departments are searching for engineers who know soils.

Soils and Drainage

What has all this to do with drainage? I believe that when soils are known, their action in contact with water will be known. The two must go together. The solution for broken roads caused by unstable soil conditions will be found when rules for controlling soils are established.

From a paper presented at the Twenty-Third Annual Purdue Road School.

Bulletins and Pamphlets

For free distribution to contractors, engineers and officials. Write for the catalogs you need.

Mechanical Control for Shovels

327 Link-Belt shovels, cranes and draglines, a feature of which is the Speed-o-Matic control designed to eliminate operator fatigue and thus speed up operations, are described in literature which may be secured from the Link-Belt Co., 300 West Pershing Road, Chicago, Ill.

Curing Concrete With Calcium Chloride

328 A summary of recent improvements in the integral use of calcium chloride for curing concrete, which should be of interest and value to all contractors and engineers, is contained in Brief No. 126 compiled by the Calcium Chloride Association, Penobscot Bldg., Detroit, Mich., which they will be glad to send on request.

Bituminous Distributors

329 The Austin-Western Road Machinery Co., 1815 Barrows St., Aurora, Ill., will be glad to send to all interested contractors and state and county highway engineers complete information on its line of bituminous distributors which are claimed to be dripless and capable of delivering a constant, accurate volume of any material any spray bar length.

A New Multi-Bucket Excavator

330 The new Ruth Multi-Bucket excavator for digging or cleaning ditches, rock excavation, borrow pit excavation, levee construction and similar dirt-moving jobs is described in literature which the Ruth Dredger Mfg. Co., 5980 So. Boyle Ave., Los Angeles, Calif., will be glad to send on request.

Concrete Vibrators

331 The features of the various types of White concrete vibrators and accessories are described in a new illustrated circular, No. 24-B, recently issued by the White Manufacturing Co., 1227 West Beardsley Ave., Elkhart, Ind., which will be glad to send copies to those interested upon request.

A Portable Drinking Fountain

332 Meeting the need for a sanitary and portable method of dispensing drinking water on construction jobs, the Port-A-Fount water carrier has been developed by the Magnetic Signal Co., 3355 East Slauson Ave., Los Angeles, Calif., which will be glad to send to all interested its bulletin describing and illustrating this sanitary drinking fountain.

Building Skid-Safe Roads

333 Complete information on the use of Tarvia to "tractionise" roads and thus render them skid-safe may be secured by interested highway engineers and contractors direct from the Barrett Co., 40 Rector St., New York City.

Tractors for Snow Removal

334 The features of Cletrac tractors which make them particularly adaptable to snow removal work are described and illustrated in new literature which the Cleveland Tractor Co., Cleveland, Ohio, will be glad to send on request.

New Compressor Co. Bulletin

335 Copies of the "Davey Diary," a monthly bulletin with news of interest to dealers and users of Davey compressors, may be secured by those interested direct from the Davey Compressor Co., Inc., Kent, Ohio, by mentioning this magazine.

SEND THIS BACK—WE'LL DO THE REST

CONTRACTORS and ENGINEERS MONTHLY
470 FOURTH AVE., NEW YORK

Please send me the following literature, without cost or obligation

(Indicate by numbers)

Name_____

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*P.S. Also send me catalogs and prices on*_____

New Literature on Pumps and Mixers

336 Literature describing and illustrating the new Rex drum mixers and Speed Prime pumps, claimed to be lighter, stronger, and easier to handle, with new portability and greater capacity for hard work, has been issued recently by the Chain Belt Co., 1666 W. Bruce St., Milwaukee, Wis., which will be glad to send copies upon request.

A Utility Compressor Unit

337 A compact, self-contained utility compressor unit for mounting on a motor truck, allowing room for the transportation of tools, men, and other equipment required, is fully described and illustrated in Bulletin No. 2320A recently issued by Ingersoll-Rand Co., 11 Broadway, New York, N.Y., which will be glad to send copies on request.

Pusher Snow Plows

338 Heil pusher-type snow plows, which are designed to require a minimum of pushing effort and are reinforced throughout to stand the gaff, are described in literature which interested state, county and township highway engineers may secure direct from the Heil Co., 3000 W. Montana St., Milwaukee, Wis.

New Disc Tamping Roller

339 Complete information on the Parsons disc tamping roller, a tractor-pulled unit for compacting earth in fills, levees, earth dams, road bases and shoulders, may be secured from the Parsons Co., Newton, Iowa.

The Screen with a New Motion

340 The features of Robins Eliptex Screens for horizontal installation are described in detail and illustrated in Bulletin No. 99-A, copies of which are available to those interested upon request direct from the Robins Conveying Belt Company, 15 Park Row, New York, N. Y.

New Portable Mixing Plants

341 Bulletin T-250 describing Hetherington & Berner's new type portable folding plant for secondary road work, a feature of which is its adaptability to standard flat bed truck and trailer hauling, may be secured by those interested direct from Hetherington & Berner, Inc., 701-45 Kentucky Ave., Indianapolis, Indiana.

Maintenance Equipment Bulletin

342 The complete line of Littleford maintenance equipment, including various types of tar and asphalt heaters, kettle accessories, hand spray attachments, paving tools and crack and joint filling pots, is described and illustrated in Bulletin M-1, which may be secured by those interested direct from Littleford Bros., 485 E. Pearl St., Cincinnati, Ohio.

New Snow Plow and Wing

343 The new Adams snow plow and snow wing for use with Adams graders Nos. 50, 51, 301 and 151, which is a high-lift streamlined unit of large capacity for keeping state, county and township roads open during the winter months, are described and illustrated in new literature which the J. D. Adams Co., Indianapolis, Ind., will be glad to send on request.

Portable Electric Plants

344 Kato portable electric plants which provide 110 volts alternating current anywhere for operating floodlights, portable electric tools, and similar uses, as well as gas-engine ac and dc plants up to 10,000 watts and diesel-driven 3, 6 and 8-kw plants, are described in literature which may be secured direct from the Kato Engineering Co., Mankato, Minn.

Concrete Equipment Catalog

345 The complete line of Garbro concrete handling equipment, including buckets, drop hoppers, pneumatic-tired carts and wheelbarrows, is described in a new catalog which Garlinghouse Bros., 2416 East 16th Street, Los Angeles, Calif., will send on request.

New Crusher Catalog

346 A new 44-page catalog, describing Bartlett & Snow single roll, two-roll and four-roll crushers, crushing rolls, swing hammer pulverizers, rotary crushers and various types of feeders and containing engineering diagrams, capacity tables and suggestions for plant set-ups, has recently been issued by the C. O. Bartlett & Snow Co., Cleveland, Ohio, which will be glad to send copies on request. Ask for Catalog No. 77.

Bulletins and Pamphlets

(Continued from preceding page)

Truck-Tractors As Snow Fighters

347 Literature describing the new Linn snow fighters, consisting of snow plow-equipped Linn tractors which have speeds to 11.8 mph and are powered with gasoline or diesel engines may be secured direct from the Linn Mfg. Corp., Morris, N. Y.

Pile Driving Hammers

348 The Union Iron Works, Inc., Elizabeth, N.J., will be glad to send to those interested its latest pamphlet on Union hammers, containing interesting illustrations showing various applications of this piece of equipment on a number of construction projects throughout the country.

Portable Mixing Plants

349 Cedar Rapids portable mixing plants and their advantages are described in detail in a new illustrated booklet recently issued by the Iowa Manufacturing Co., Cedar Rapids, Iowa, which is available to all interested contractors, state and county highway engineers upon request.

Dirt-Moving Equipment

350 Complete information on the use of LeTourneau Angledozers and bulldozers with Caterpillar tractors is contained in illustrated bulletins recently issued by R. G. LeTourneau, Inc., Peoria, Ill., and Stockton, Calif., which they will be glad to send to those interested upon request.

Weed Burner and Spray Outfit

351 The Aeroil No. 99 weed burner, claimed by the manufacturer to be a tool of 101 uses, as well as other models, one of which is a combination burner, sprayer, disinfecting, heating and thawing torch, is described and illustrated in literature recently issued by the Aeroil Burner Co., Inc., West New York, N.J., which may be secured direct from the manufacturer upon request.

Welding in Construction Work

352 This is the title of a new 12-page booklet describing and illustrating the variety of applications of arc welding in the structural field, both in the erection of structures and in the maintenance of construction machinery, which was recently published by the Lincoln Electric Co., of Cleveland, Ohio. Copies may be secured free upon request direct to that company.

Diesel Engine Applications

353 A new 32-page booklet describing and illustrating the various applications of Caterpillar diesel engines to supply power for a large number of different types of services has recently been published by the Caterpillar Tractor Co., Peoria, Ill., which will be glad to send copies on request. Ask for Form No. 4127.

New High-Lift Snow Plow for Graders

354 The new Galion high-lift wide-discharge snow plow for use with Galion motor graders is described and illustrated in literature which may be secured by state, county and township highway engineers direct from the Galion Iron Works & Mfg. Co., Galion, Ohio.

New Catalogs on Cranes

355 The construction features of Bay City cranes, Models 42 and 45, are fully described and illustrated in Bulletins 42B and 45B respectively, which Bay-City Shovels, Inc., Bay City, Mich., will be glad to send to contractors and engineers upon request.

Heavy Machinery Trailers

356 Complete information on the heavy-duty machinery trailers in varying models and capacities made by C. R. Jahn Co., Builders Bldg., Chicago, Ill., may be had by writing direct to that company.

Derricks and Winches

357 Complete information on the Sasgen line of derricks and winches for construction jobs may be secured by interested contractors and engineers direct from the Sasgen Derrick Co., 3101 W. Grand Ave., Chicago, Ill.

Power for Portable Pumps

358 The Lauson Co., 55 Michigan St., New Holstein, Wis., will be glad to send to those interested complete specifications on its line of Lauson Smoothflo gasoline engines, available in ½ to 5 hp sizes, for use with small portable pumps and similar applications.

Concrete Truck-Mixers and Agitators

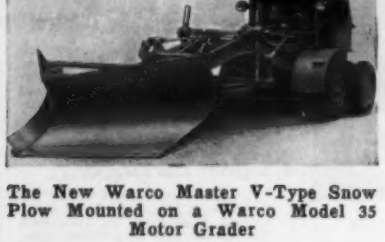
359 New literature has been issued recently, describing Blaw-Knox Trukmixers and agitators and covering the complete service rendered by Blaw-Knox to the ready-mixed concrete industry, which may be secured direct from the Blaw-Knox Co., 2067 Farmers Bank Bldg., Pittsburgh, Pa. Ask for Catalog No. 1582.

Self-Priming Centrifugal Pumps

360 Power pumps which, according to the manufacturer, embody every refinement and improvement that research has been able to suggest, are described and illustrated in a new bulletin, No. 25B, which the Barnes Manufacturing Co., Mansfield, Ohio, will be glad to send to those interested upon request.

Roller Conveyors for Materials

361 The time and money-saving applications of Standard gravity conveyors to material handling problems is described and illustrated in a new 8-page bulletin recently issued by the Standard Conveyor Co., North St. Paul, Minn., which they will be glad to send to those interested upon request.



The New Warco Master V-Type Snow Plow Mounted on a Warco Model 35 Motor Grader

V-Type Grader Snow Plow

Warco V-type snow plows for mounting on Warco motor graders from 5 to 8 tons in weight and which are designed to buck snow drifts and push through deep snows employ the same lifting mechanism as the grader scarifiers. The plows are rigidly constructed and are designed for heavy-duty service.

Complete details on these snow plows and on Warco graders are contained in literature which may be secured direct from the W. A. Riddell Corp., Bucyrus, Ohio, by mentioning this magazine.

New P & H Sales Engineer For Western New York Area

The Harnischfeger Corp., of Milwaukee, Wis., has announced the appointment of C. H. Boenig of Youngstown, N. Y., as P & H Sales Engineer for the western section of New York State, including the City of Buffalo, with Rochester as the eastern boundary line. Mr. Boenig, who has served as Supervisory Engineer in charge of highway, bridge, water works, sewage treatment plant and building construction for the Department of the Interior, will handle the entire line of P & H products, including crawler-type excavators, truck cranes, trenching equipment, overhead cranes, electric hoists and Smootharc welders and welding rods.

New Alloy Steel Rod

A new gas welding rod, the Airco No. 1 high ductility alloy steel rod, has recently been developed by the Air Reduction Sales Co., Lincoln Bldg., New York City. The feature of this new rod is its ability to withstand considerable heating without burning.

The free-bend ductilities of single-layer welds made with this new rod range from 20 to 30 per cent, depending on the composition of the steel while that of multi-layer welds on low and medium-carbon steels are up to 40 per cent. The ultimate tensile strengths are in excess of 60,000 pounds per square inch, according to the manufacturer. The specific gravity of the welds are 7.80-7.86 and the Charpy impact values on keyhole notched specimens at 70 degrees F. are from 15 to 30 foot-pounds.

During the past 3 or 4 years, the Federal Government has become much more interested in the improvement of the so-called secondary roads. About one-fourth of the emergency appropriations in recent years has been spent for improving these roads that go back off the main highway to the farmer's gate. Congress has authorized the expenditure of $25,000,000 of Federal funds for 1938 and again in 1939 to be used on secondary and feeder roads of this sort.

Equipment Distributors

The Directory of Equipment Distributors is continued on the pages following.

Alabama–California

TURNER SUPPLY COMPANY

N. W. Corner of St. Louis and Commerce Sts.
MOBILE ALABAMA

Representing

McKIERNAN-TERRY CORP.—Pile Hammers
INDEPENDENT PNEUMATIC TOOL CO.—"Thor" Air and Electric Tools
WILLIAMS—Clamshell and Dragline Buckets
AMERICAN STEEL & WIRE CO.—"Moniter" Wire Rope
DOMESTIC—Pumps and Hoists
M & M Form Clamps
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HOUGH-UNIVERSAL—Sweepers
MASTER—Vibrators, Generators, Arc Welders
SULLIVAN—Air Compressors, Tools
TRACKSON—Crawlers, Shovels and Bulldozers
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BAY CITY Shovels and Cranes
BETHLEHEM Reinforcing Bars
PIONEER Crack and Joint Filler
KENNEDY Crushers, Screens, Elevators
LeROI High Efficiency Air Compressors
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McCORMICK-DEERING Industrial Tractors
KWIK-MIX Mixers
RIDDELL Power Grader
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Littleford Bros.—Road Oil Distrs., Heating Kettles, etc.
McKiernan-Terry Corp.—Pile Hammers, Hoists
Nelson Iron Works—Loaders and Belt Conveyors
The Parsons Company—Trench Machines, Snow Plows
W. A. Riddell Corp.—Power Graders

Member: Associated Equipment Distributors

J. JACOB SHANNON & COMPANY

1744—Sedgley Avenue—1744
PHILADELPHIA

Representing

T. L. Smith Co.—Concr. Truck Mixers, Pavers, Glass Mixers
Allis-Chalmers Mfg. Co.—Tractors, Graders
C. H. & E. Mfg. Co.—Pumps, Saw Rigs, Rollers, Hoists
Baker Mfg. Co.—Bulldozers, Blade & V Type Snow Plows
John A. Roebling's Sons Co.—Wire rope, Fittings
Concrete Surfacing Machinery Co.—Berg Surfacers
Sasgen Derrick Co.—Derricks and Winches
Schramm, Inc.—Air Compressors, Pneumatic Tools
Clyde Iron Works—Gas, Elec., Steam Hoists
Shannon—Derricks and Derrick Fittings
Clayton Mfg. Co.—Kerrick Cleaners
David Round & Son—Chain Hoists & Winches
Blaw-Knox Co.—Dirt Movers, Bulldozers, Sheep's Foot Tampers
Gar Wood—Scrapers, Bulldozers
Richmond Screw Anchor Co.—Form ties

Member: Associated Equipment Distributors

WESTERN MATERIAL CO.

Aberdeen, Sioux Falls, Rapid City, S. D.

Athey Digging Loaders, tools
Baldersen Snow Plows
Barber-Greene Ditchers, Loaders
Bales Wire Ties
Buyrus-Erie "Loadmaster"
Butler Bins, Hoppers
Philip Carey Expansion Joints
"Caterpillar" Equipment
Chain Belt Pump, Mixers
Clyde Sales Hoists
D-A Lubricants
Davey Compressors
Day Crushers
Harris "Russell" Road Equip.
Hester Pitreline Plows
LaPlant-Choate Tractor Equip.
LeTourneau Dirt-moving Equip.
Littleford Heating Equip.
Manhattan Belting
Pioneer Crushing Plants
Slusser-McLean Scrapers, Fresnos
Stolle Stone Spreaders
Tarr Mowers
Walter Motor Trucks
Williamette-Hyster Winches, Hysters
Athey Wagons
John Deere Industrial Tractors
Killefer Fresnos, Scrapers

Member: Associated Equipment Distributors

NIXON-HASSELLE COMPANY INC.

Contractors' Equipment
Chattanooga Tennessee

Representing

BLAW-KNOX Buckets, Forms
INGERSOLL-RAND Compressors
MUNDY Hoists
AUSTIN-WESTERN Graders, Crushers, Rollers, etc.
BARBER-GREENE Loaders, Conveyors
NORTHWEST Cranes, Shovels
HOMESTEAD Hypressure Jenny
ARCHER Towers, Spouting Equipment
REX Mixers, Pavers, Pumps
CLETRAC Tractors
NEWPORT Culvert Pipe
VULCAN Gasoline Locomotives
DOBBIE Derricks
HOUGH—"Universal" Road Sweeper
LIDGERWOOD Hoists
SYNTRON Hammers, Vibr.
BARCO Gas. Paving Breakers

Also Wheelbarrows, Carts, Benders, Cutters, Shovels, etc.

Member: Associated Equipment Distributors

BROOKS-PAYNE-OSBORNE EQUIPMENT CO.

Knoxville 408 Davenport Rd. Tennessee

Representing

J. D. Adams Co.
Buyrus-Erie Co.
Continental Roll & Steel Co.
Crushtie Steel Co.
Oravo-Doyle Co.
Foote Co., Inc.
Gardner-Denver Co.
Heltzel Steel Form & Iron Co.
Cincinnati Rubber Mfg. Co.
Hug Co.
Independent Pneu. Tool Co.
Jaeger Machine Co.
C. S. Johnson Co.
Linn Mfg. Corp.
Master Vibrator Co.
McKiernan-Terry Corp.
Owen Bucket Co.
Pioneer Gravel Eq. Mfg. Co.
Rosco Mfg. Co.

Member: Associated Equipment Distributors

WILSON-WEESNER-WILKINSON CO.

Nashville Tennessee

Representing

Koehring Co.
Insley Mfg. Co.
Allis-Chalmers Mfg. Co.
Blaw-Knox Co.
C. H. & E. Mfg. Co.
Gorman-Rupp Co.
The Parsons Co.
T. L. Smith Co.
Ingersoll-Rand Co.
Littleford Bros.
McKiernan-Terry Corp.
Smith Engineering Works
Amos Baldwin Wyoming Co.
Baker Mfg. Co.
Cleaver-Brooks Co.
Clyde Sales Co.
E. D. Etnyre Co., Inc.

NASHVILLE—KNOXVILLE
Warehouse Stocks of Service
Reinforcing Steel and Mesh

Member: Associated Equipment Distributors

BROWNING-FERRIS MACHY. CO.

205 Exposition Ave. Dallas, Texas
Texas at Rice Sts. Houston, Texas

Representing

Heltzel Steel Form & Iron Co.
Lakewood Engineering Company
Barber-Greene Company
Sterling Wheelbarrow Co.
Jaeger Machine Company
Ingersoll-Rand Co.
Foote Co.—Pavers
Littleford Bros.
Thew Shovel Company
Trackson Co.—Crawlers, Hoists
McCormick-Deering—Tractors
Lidgerwood Mfg. Co.
Galion Iron Works & Mfg. Co.
Chas. Hvass & Co., Inc.

Member: Associated Equipment Distributors

R. B. EVERETT & CO.

3112-18 Harrisburg Blvd. Houston, Texas

BLAW-KNOX Road Plant Equipment, Bins, Clam Shell Buckets
AMERICAN Hoisting Machinery
"P. & H." Gasoline Cranes
McKIERNAN-TERRY Pile Hammers, etc.
CONNERY Asphalt Equip.
CHAIN BELT Concrete Mixers, Saw Rigs, Pavers
NOVO Engines, Hoists, Pumps
"RED STAR" Wheelbarrows
SAUERMAN Cableways
BATES Wire Ties
PULSOMETER & NYE Steam Pumps
PATENT Safety Swinging Scaffolding
TRU-LAY Wire Rope
BUFFALO-SPRINGFIELD Road Builders
SULLIVAN Compressors
PORTABLE Conveyors
ETNYRE Asphalt Distrs.
FLYNN Surgrader
PAGE Dragline Buckets
MALL Vibrators

Member: Associated Equipment Distributors

PHILLIPS MACHINERY CO.

900 East Cary St. Richmond, Va.

Representing

Austin Machinery Corp.
Butler Bin Company
Clyde Sales Co.
Chicago Automatic Conveyor Co.
DeWalt Products Corp.
Jackson Mfg. Co.
Sauerman Brothers, Inc.
Chicago Pneumatic Tool Co.
Stephens-Adamson Mfg. Co.
Rogers Brothers Corp.
General Excavator Co.
Aeroil Burner Co.
Manitowoc Engineering Works
Broderick & Bascom Rope Co.
Chain Belt Company
Van Dorn Electric Tool Co.
Master Vibrator Company

Member: Associated Equipment Distributors

PACIFIC HOIST & DERRICK CO.

Machinery and Equipment

3200 4th So. Seattle, Wash

Representing

NORTHWEST—Gas and Electric Shovels, Cranes and Draglines
TWIN DISC—Clutches for all purposes
PAGE—Scraper Buckets, Diesel Draglines
MINNEAPOLIS—"Twin City" Gas Engines
CLIMAX—Gasoline Engines
WISCONSIN—Gasoline Engines
DAKE ENGINE CO.
ISAACSON IRON WORKS—Buckets
CLETRAC—Tractors & Bulldozers
DAVEY—Air Compressors
FEDERAL—Trucks

Member: Associated Equipment Distributors

CONSTRUCTION EQUIPMENT CO.

1118-1124 Ide Ave., Spokane, Wash.

Aeroil Burner Co.
Archer Iron Works
Beebe Bros.
Blystone Mfg. Co.
Broderick & Bascom Rope Co.
Buffalo-Spgfld. Roller Co.
Butler Bin Co.
Chain Belt Co.
Climax Eng. Co.
D-A Lubricant Co.
Detroit Graphite Co.
DeWalt Products Co.
Fairbanks, Morse & Co.
Fate-Root-Heath Co.
Garco Manufacturing Co.
Homestead Valve Mfg. Co.
Kalamazoo Ry. Supply Co.
LeRoi Co.
Lindo Air Products Co.
M. & M. Wire Clamp Co.
Niagara Mfg. Co.
Bates Valve Bag Corp. (Wire Ties)
Sasgen Derrick Co.
Sheldon Mfg. Co.
Sterling Wheelbarrow Co.
Sullivan Machinery Co.
Sunbeam Mfg. Co.
Templeton, Kenly & Co.
Thew Shovel Co.
Willamette-Hyster Co.
"Williams" Buckets & Trailers
Young Iron Works

Member: Associated Equipment Distributors

BOEHCK EQUIPMENT CO.

2404 W. Clybourn St. Milwaukee, Wis.

Representing

Barber-Greene Co.
Jaeger Machine Co.
Byers Machine Co.
LeRoi Co.
A. Leschen & Sons Rope Co.
Wellman Engineering Co.
W. Toepfer & Sons Co.
C. S. Johnson Company
Corrugated Steel Sheet Piling Corp.
McKiernan-Terry Corp.
Homestead Valve Mfg. Co.
Sasgen Derrick Co.
American Hoist & Derrick Co.
Richmond Screw Anchor Co.
Jones-Superior Machine Co.
Construction Accessories, Inc.
Independent Pneumatic Tool Co.
Gruendler Tool Co.
Production Equipment Co.
Hetherington & Berner Co. Inc.

Member: Associated Equipment Distributors

DROTT TRACTOR CO., Inc.

3841 W. Wisconsin Ave.
Milwaukee Wisconsin

Representing

ALLIS-CHALMERS Tractors, Graders, Speed Patrols, Hauling and Power Units
OSHKOSH 4-wheel Drive Trucks
PIONEER Gravel Equipment
WAUSAU Snow Plows
DROTT Bulldozers, Scrapers, Scarifiers, Hydraulic Equipment, etc.
HAUCK Kettles, Heaters
LaCROSSE Trailers
KOB Sand Spreaders
HERCULES Road Rollers
CLEVELAND Rock Drills
DAVEY Air Compressors
RUSSELL Scrapers, Plows
TIMKEN Roller Bearings
CONTINENTAL Dirt-Moving Scrapers
AMERICAN Cable
HOUGH Loaders, Sweepers
CUMMINS Diesel Engines

Member: Associated Equipment Distributors

INDUSTRIAL ENGINE PARTS, INC.

1053 E. 61st St. Cleveland, Ohio

Representing

Minneapolis-Moline Power Impl. Co.
Climax Engineering Co.
Twin Disc Clutch Co.
Fuller & Johnson Corp.
Wisconsin Motor Corp. (Air-Cooled)
Stover Engine & Mfg. Co.
Scintilla Magneto Co.
Wico Electric Co.
Pierce-Governor Co.
Lafol Co.

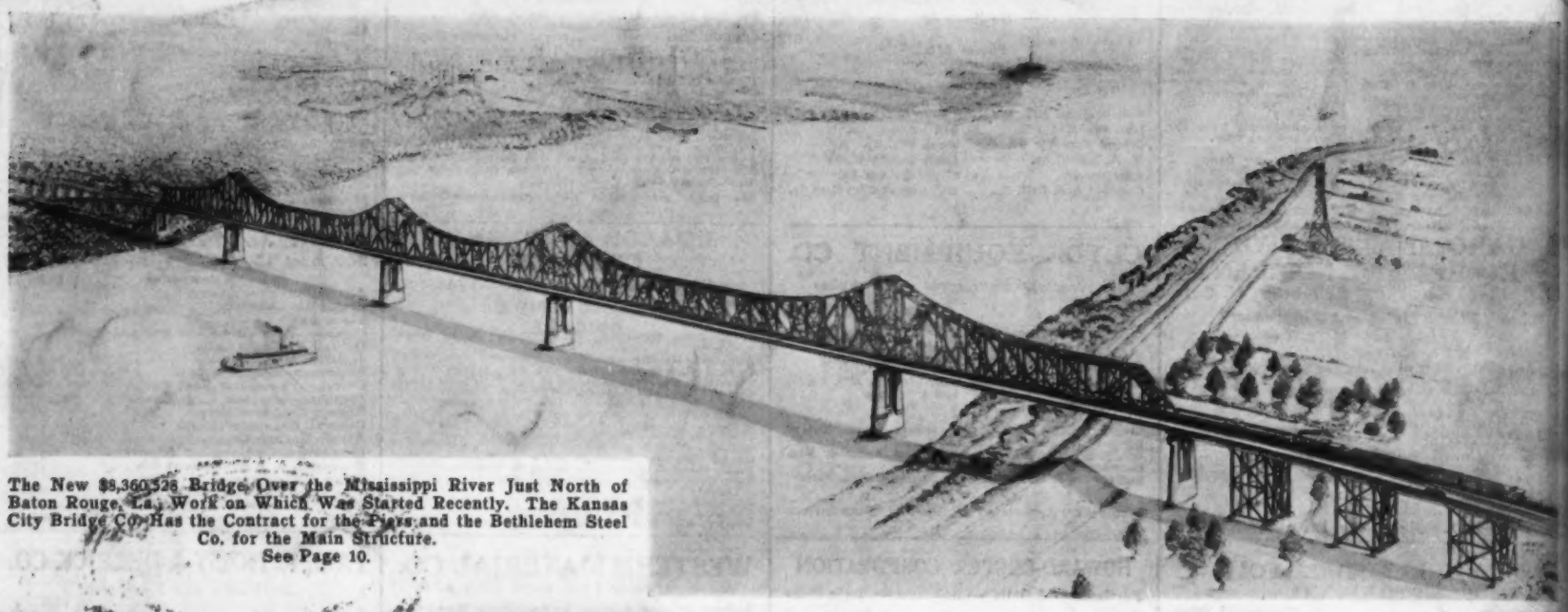
W. T. WALSH EQUIPMENT CO.

3088 West 106th St., Cleveland, Ohio. Tel. Clearwater 4400

Iowa Mfg. Co.
Cedar Rapids—Crushers
Bennet Company—Crushers
Cleveland Rock Drill Co.—Air Tools
Anthony—Dump Bodies
The C. S. Johnston Co.
Foote Company—Pavers
General Excavator Co.—Shovels
Hough-Universal—Sweepers
Wm. Bros Mfg. Co.—Tamping Rollers
White Mfg. Co.—Asphalt Plants, Tar Kettles, Kerosene Torches, Conor. Vibrators
McKiernan-Terry Corp.—Pile Hammers
Michigan—Power Shovels
Novo Engine Co.—Engines, Light Plants, Pumps
R-B Equipment Co.—Finegraders
Rosco Mfg. Co.—Rosco Distributors & Oilers
Schramm, Inc.—Air Compressors
Timken—Bits
Viber Co., Ltd.—Vibrators
Wellman Engineering Co.—"Williams" Buckets
Allis-Chalmers—Tractors
Construction Mashy. Co.—Mixers

Member: Associated Equipment Distributors

Contractors and Engineers Monthly



The New $8,360,526 Bridge, Over the Mississippi River Just North of Baton Rouge, La., Work on Which Was Started Recently. The Kansas City Bridge Co. Has the Contract for the Piers and the Bethlehem Steel Co. for the Main Structure.
See Page 10.

Scene on the N. S. Mackie Co. 47th Street Traffic Relief Project for the Chicago Park District, Which Included a Grade Separation, Underpass and Intercepting Sewer.
See Page 11.

Bon Homme County, S. D., Operated This Caterpillar RD7 with LaPlant-Choate Snow Plow Last February, Clearing a Mile an Hour in Drifts Like These.

An Elevating Grader on an Oregon Road Job.
See Page 1.

Permanent Evergreen Snowbreak in Delaware County, Pa. See Page 7.

The "Kenny"—the U. S. E. D.'s Hyacinth Destruction Plant. See Page 18.

A Cletrac Model F Tractor and Sargent Snow Plow Owned by Colo. State Hwy. Dept., Which Last Winter Kept Wolf Creek Pass in the Rockies Open for the First Time.

C. & E. M. Photo

Three Scenes on the Feather River Route. Left, the Pulga Highway Bridge Crossing Feather River and a Railroad Bridge Near the Highway Tunnel; Center, Drilling Tunnel No. 1, and Right, Some of the Difficulties of the Early Stages of the Work.
See Page 1.